THE MICROSCOPIC CHANGES IN THE BLOOD DURING PREGNANCY AND THE PUERPERIUM WITH SPECIAL REFERENCE TO LEUCOCYTOSIS.

A Thesis for the Degree of M.D.

by

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When resident at the Royal Maternity and Simpson Memorial Hospital, my attention was drawn on several occasions to patients, who, after delivery, developed slight rises of temperature at night, these rising on subsequent nights, perhaps half a degree higher for three or four nights. No pain would be complained of, frequently the lochia were quite normal in amount and quality, though occasionally they became offensive. The involution of the uterus appeared to be progressing favourably: the pulse rarely rose above 80 per minute, and after three or four days the temperature itself became normal and remained so for the rest of the time the patient remained in Hospital. Such occurrences gave me at the time a good deal of anxiety, fearing that they were indices of septic changes going on in intero, though I felt confident that the placenta and membranes had been expelled intact. This led me on several occasions to examine the blood of these patients, in order to ascertain whether there was any evidence of a leucocytosis, which if present, might help one towards a diagnosis of the condition, and also give one an early guide to the correct treatment./

ment.

The immense importance of any such aid to the early diagnosis of puerperal complications, will be readily granted, as there is probably no class of case which gives the general practitioner more anxiety.

One would hardly expect, of course, that a blood examination, would in any way take the place of a thorough examination of the clinical aspects of the case in all its bearings and whatever evidence might be obtained from the blood, should of course be taken in conjunction with the other clinincal signs and symptoms.

The importance of leucocytosis as an aid to the diagnosis of many obscure conditions is now generally recognised, and in various branches of medicine, use is frequently made of this sign.

Accordingly I thought, that an investigation into the leucocyte count in the puerperium might prove of some value, and a record of the observations made on 50 puerperal cases forms the bases of the present Thesis.

Before proceeding to the detailed observations, it may be well to glance for a moment at the ordinary conception of leucocytosis.

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By leucocytosis one means an increase in the leucocytes of the peripheral blood. For ordinary purposes, the normal leucocyte count may be taken as from 5-10000 per cub. m.m., there being considerable individual variations. The most common type of leucocytosis with which we ordinarily meet, is one in which there is an absolute and relative increase in the polymorphonuclear leucocyte, with an accompanying diminution in the other types of leucocyte. This polymorphonuclear leucocytosis is met with in many varieties of Pathological and Physiological conditions. The other type of leucocytosis where we have an increase in all the forms of leucocytes, the normal proportion remaining unchanged, is rarer and more particularly met with under certain physiological conditions.

The causes of all forms of leucocytosis may be grouped under the headings of A. Physiological: B. Pathological.

A: Physiological Leucocytosis.

I. In the new born child, the leucocytes number 15-20000, or even higher. This may increase for 48 hours and then subsequently falls to 10-15000 per c. m.m.

II. During digestion there is a distinct leucocytosis/

leucocytosis. If the blood be examined after a meal rich in proteids, one finds a leucocytosis of about 10000 per cubic millemeter, perhaps higher in vigorous individuals, but this varies naturally according to the leucocyte count normal to the individual. Fasting has the reverse effect, it lowers the leucocyte count very markedly.

III. By the mechanical application of massage and electricity and cold baths, or atmospheric cold, and after muscular exercise, the blood is found to have an excess of leucocytes, though no special variety preponderates, prolonged heat seems to have the same effect.

IV. Shortly before death, especially if the patient be slowly dying, there may be an excess of leucocytes.

V. Leucocytosis of Pregnancy and Parturition. This is discussed later.

A. Pathological Leucocytosis.

Leucocytosis then is found in a great variety of pathological conditions, more particularly in inflammatory and toxic conditions, thus we see it in cases of, Pneumonia, Follicular Tonsillites, Scarlet/

Scarlet Fever, Rheumatic Fever, Variola, Diphtheria, Erysipelas, Malignant Disease, Malignant Endocarditis. The secondary stage of Syphilis, Endo Metritis, Salpingitis, Peritonitis, Appendicitis, and Abscess in and around the kidney, and large abscesses in connection with any organ. Septicaemia and Pyaemia and septic conditions generally; also in toxic conditions produced by various substances, such as gas poisoning; after ingestion of salicylates, quinine poisoning, and after the inhalation of ether.

It is interesting to note that in many fevers, such as Enteric, Malaria, Influenza, Measles, uncomplicated Tuberculosis, there is either no increase or actual decrease, giving us an important point in differential diagnosis. It might be thought from the extensive list above given of conditions causing leucocytosis, that little help may be expected in the diagnosis of any particular condition. Experience however, shows that this is not so. In a particular case one is frequently able to eliminate nearly all the above conditions, leaving an alternative diagnosis between one or two diseases, in one of which it may be that a leucocytosis does not naturally occur. In obscure cases of suppuration the great value of leucocytosis as an aid to diagnosis/

is is widely recognised, more especially perhaps in cases of appendicitis, where the presence of pus is very frequently revealed by a high leucocyte count, where the other signs of suppuration are absent. Here a count of 15,000 to 20,000 leucocytes per cubic millimeter, will sometimes determine an operation and lead to the evacuation of a large abscess cavity, which from other clinical signs might not have been suspected. In various other local inflammations, and in cases of general septicaemia, we find as a rule a definite leucocytosis, though in all those cases there is one important exception. In some cases the patients' resisting power seems to be overwhelmed from the outset by the poison, and the patient may fail to show the leucocytic reaction one might expect. Thus we may find an aid not only to diagnosis but also to prognosis from the leucocyte count, the general rule being that a patient obviously severely ill from a disease in which leucocytosis normally occurs, who shows no such rise in the leucocyte count, has very little chance of recovery. Very slight cases of infection may also fail to show a leucocytosis, but the general condition of the patient in such a case, sufficiently differentiates those cases. In attempting to draw conclusions from/

from a leucocytosis in the puerperium, we are met with the initial difficulty that in the puerperium a leucocytosis normally occurs, obviously then the case is not so simple as in the diseased conditions we have mentioned above. The first point to be determined then is, the leucocyte curve in a normal puerperium, if it be found that there is no uniformity in the leucocyte count, deductions from a high leucocyte count in any particular case are obviously very limited in their application. In order to determine this, what may be termed "normal leucocyte curve", it is necessary to study a series of normal parturitions occurring as far as possible under exactly similar conditions. These investigations were carried out in the wards of the Royal Maternity and Simpson Memorial Hospital during February, March and April of the present year, and I have to express my indebtedness to Dr Berry Hart for his kind permission to examine the cases under his charge during that period. I have also to express my thanks to the other members of the staff for their encouragement and assistance. Since it is the custom of the Hospital not to admit patients except in labour, it has only been possible in a few isolated cases to obtain blood counts previous to delivery.

The/

The observations were all made with a Thoma-Zeiss Haemocytometer. If the pipettes are kept thoroughly clean, the error with this instrument is extremely small - about 1%. The drop of blood was taken from the lobe of the ear which had previously been gently rubbed with a piece of sterilised cotton wool, to produce a slight hyperaemia. The blood was never squeezed out as this renders that drop not at all representative of the peripheral blood. The blood was in every case diluted 20 times in a solution of 5% Acetic Acid, just sufficient to dissolve the red cells, without affecting the white cells, except to make them swell up slightly.

Two separate estimations were made in every case and an average of the two taken. Where any discrepancy was found, a third drop was taken and if this did not approximate to either of the previous counts, the whole operation was repeated. It was very rarely necessary, however, to make more than two estimations.

As a practical point in the cleaning of the slide, alcohol should not be used, as this very soon dissolves the cement holding the disc on the slide. Plain water and a soft silk handkerchief

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is all that is required.

The normal number of leucocytes per cubic millimeter is from 5,000 to 1,000. In order to avoid the fallacy of the digestion leucocytosis all of the counts were made between 10 and 12 in the morning.

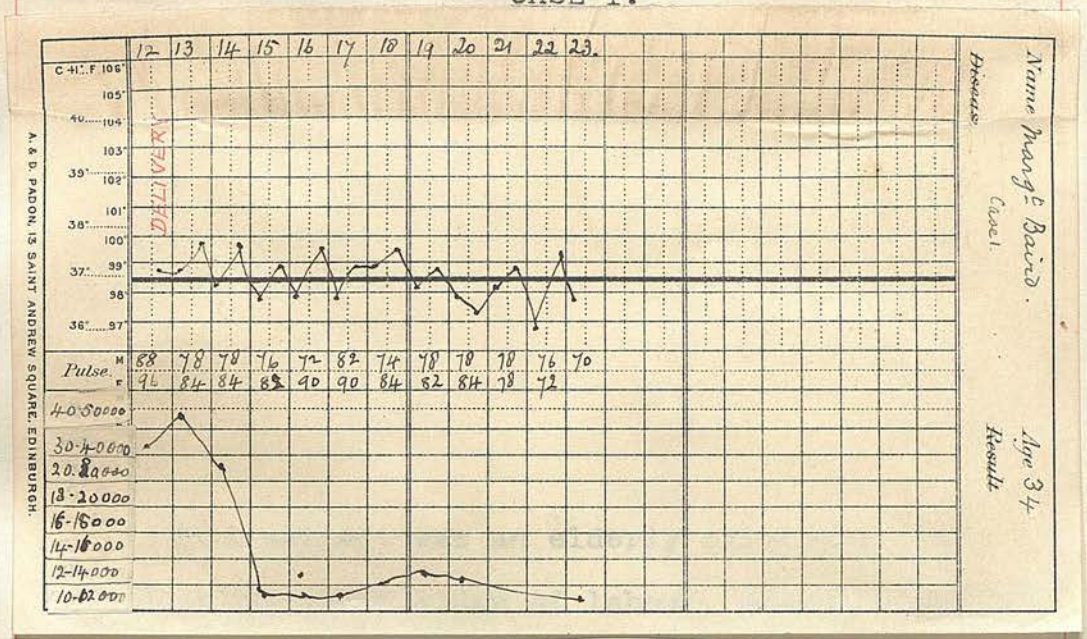
I set out each case with the actual counts made, and any notes of interest in connection with the case. Nowhere can I find a detailed account of a series of cases in which the actual daily counts are recorded; and I consider this a great loss, for though "averages" on a series of cases are of interest and of value, and give one a good conception of the "probable" counts to be expected, yet they do not emphasize the"possible" range, and these for purposes of reference are what the observer requires.

The temperature chart of a puerperal case is always of interest and gives one a good idea as a rule of how the case has progressed, therefore I give a temperature chart in each case, along with what is just as important, if not more so, the pulse rate twice daily during the puerperium. By comparing these with the actual blood counts made during successive days, one can form a very fair men-

tal/

tal picture of the case. The blood counts are roughly indicated by the lowest curve on the chart. In order to determine the exact proportion of the polymorphonuclear leucocytes present, differential counts were made in 14 cases, these were based on an innumeration of not less than 600 leucocytes, the films being prepared in the ordinary way and stained by Leishman's method. This method giving a clear picture of the nuclei and the nature of the granules present. The tables will be afterwards given. Though the investigation was primarily on the leucocytes, the number of the red blood cells at term was noted in a few cases. The cases are arranged more or less in the order in which they were examined. It is to be understood that the cases are as nearly as possible consecutive, are not selected and may be considered representative of the ordinary type admitted to the Hospital.

CASE I.



sistent Posterior position of the head, was delayed. Forceps were necessary during the second stage. There was a bad tear of the posterior vaginal wall reaching nearly to the posterior fornix: the perineum also was badly torn - both requiring stitching. The Vagina had to be very carefully dressed with light packing. The lochia became slightly foetid.

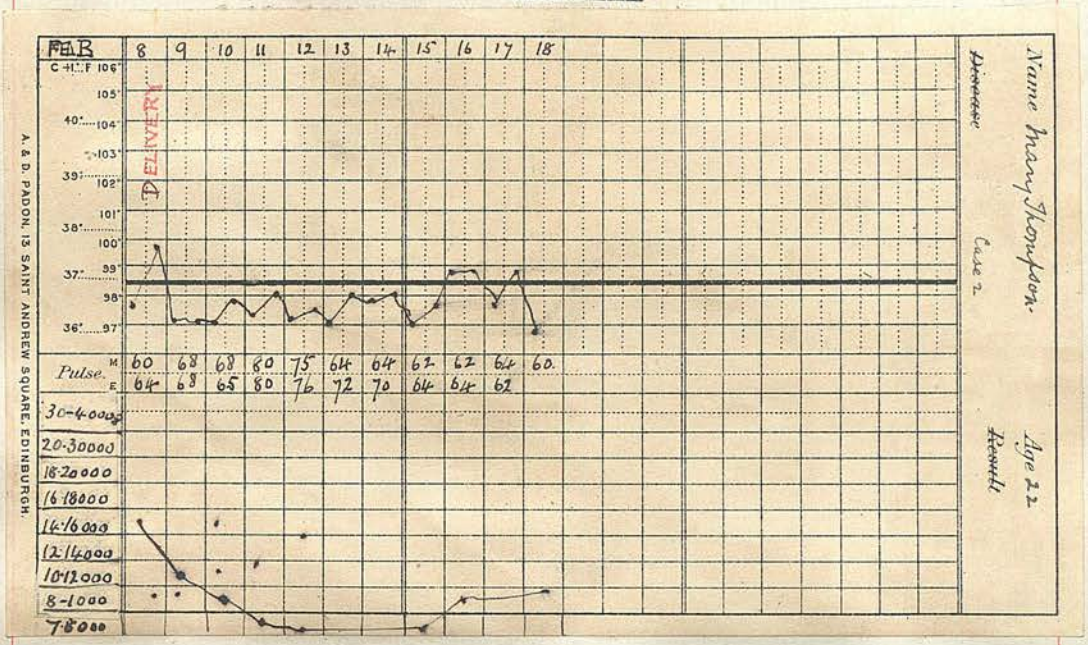
Here we have a case with an irregular temperature throughout the puerperium, but the pulse was only once above 90 per minute and that on the night of delivery.

The leucocyte count though very high during the first three days fell very remarkably on the fourth day and remained low, but never below 10,000, as is usual in most cases.

The actual counts made were as follows:----

Feb.	12th.	35625.	per	cubic	millimeter.
"	13th.	45625.	"	"	"
"	14th.	22187.	"	"	"
"	15th.	11250.	"	"	"
"	17th.	10937.	"	"	"
"	19th.	13125.	"	"	"
"	20th.	12812.	"	"	"
"	23rd.	11875.	"	"	"

CASE II.

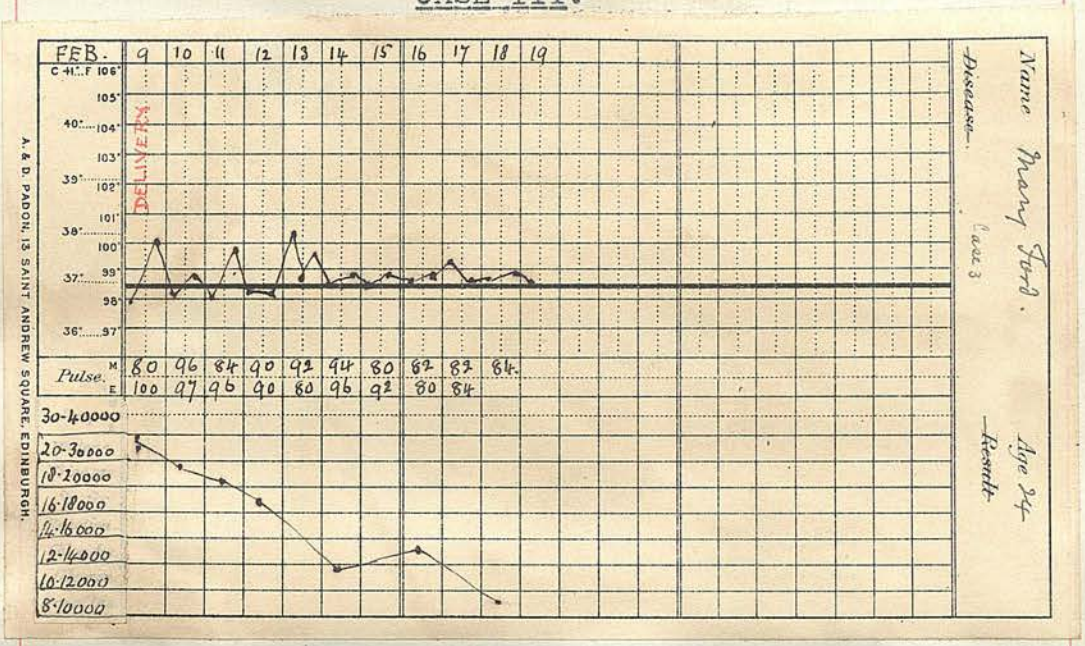


This was a primipara with a perfectly normal labour and puerperium. The leucocyte count is seen never to have been high; on the fourth day reaching below 8,000, and practically remaining so for the rest of the Puerperium. It is interesting to note the low average Temperature and pulse rate.

The actual counts were:----

Feb.	9th.	14687.	Per	cubic	millimeter.
"	10th.	11526.	"	"	"
"	11th.	8125.	"	"	"
"	12th.	7812.	"	"	"
"	15th.	7500.	"	"	"
"	18th.	8125.	"	"	"

CASE III.



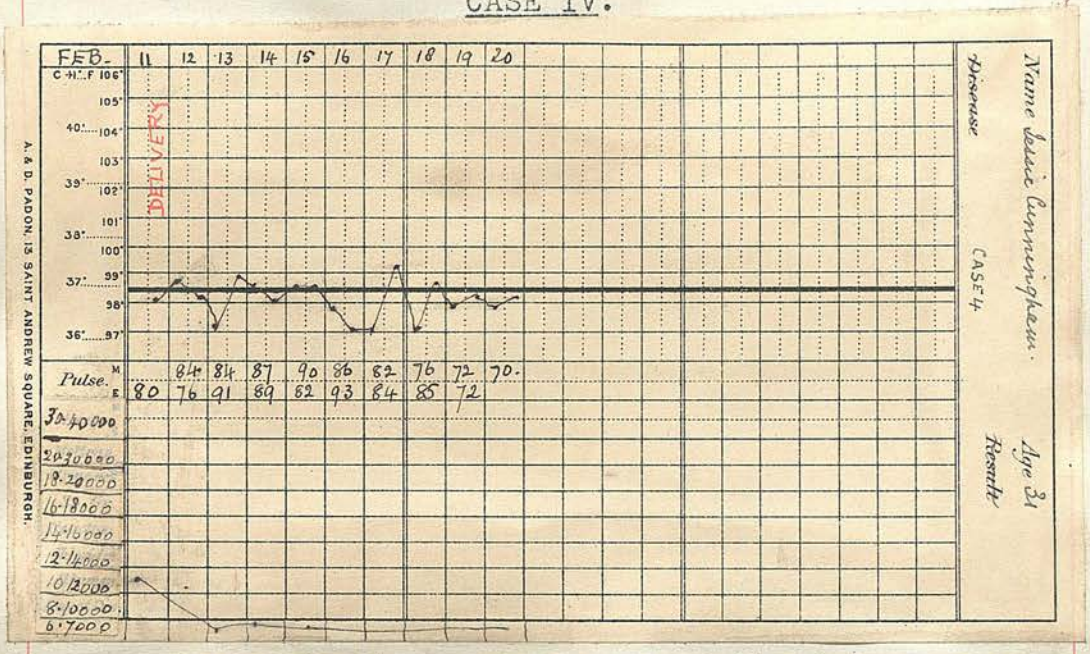
The labour in this case was a laborious one and in which delivery was effected with Forceps, and two stitches were required in the perineum. There was a slight post-partum haemorrhage.

The Temperature was on the whole high, but the pulse remained low. The leucocyte curve is also seen to have been high at first and to have been maintained so during the first week of the puerperium.

The actual blood counts made were:----

Feb.	9th	28437.	Per	cubic	millimeter.
"	10th	20000.	"	"	"
"	12th	17187.	"	"	"
"	14th.	11562.	"	"	"
"	16th.	13750.	"	"	"
"	18th	9162.	"	"	"

CASE IV.

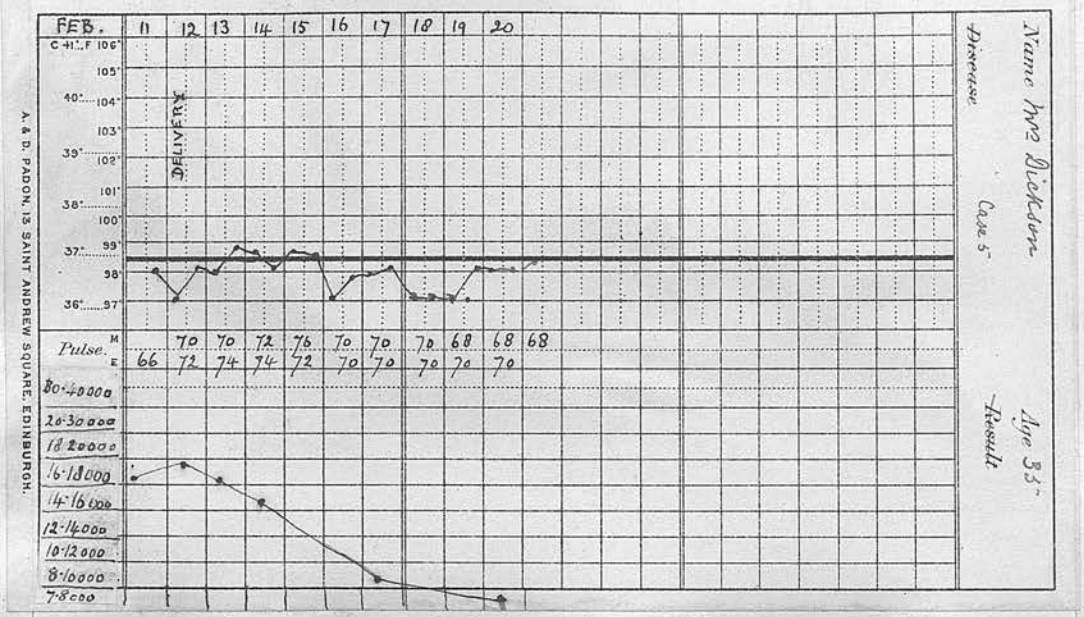


This patient was a II.para. The labour was a laborious one (LOA) a male child weighing 8 lbs, being born. The perineum was torn and three stitches were necessary. The temperature is irregular but never high. Patient had a good deal of Bronchitis. The leucocyte count never rose above the 10,000 per cent m.m. on the day of delivery, and dropped on the third day to the low figure of 6875. Patient was ill-nourished, which very likely accounted for the persistent low blood count.

The counts made were:----

Feb.	11th.	10,000	Per	cubic	millimeter.
"	12th.	9375.	"	"	"
"	13th.	6875.	"	"	"
"	16th.	7187.	"	"	"
"	18th.	75,00 .	"	"	"
"	20th.	7812.	"	"	"

CASE V.

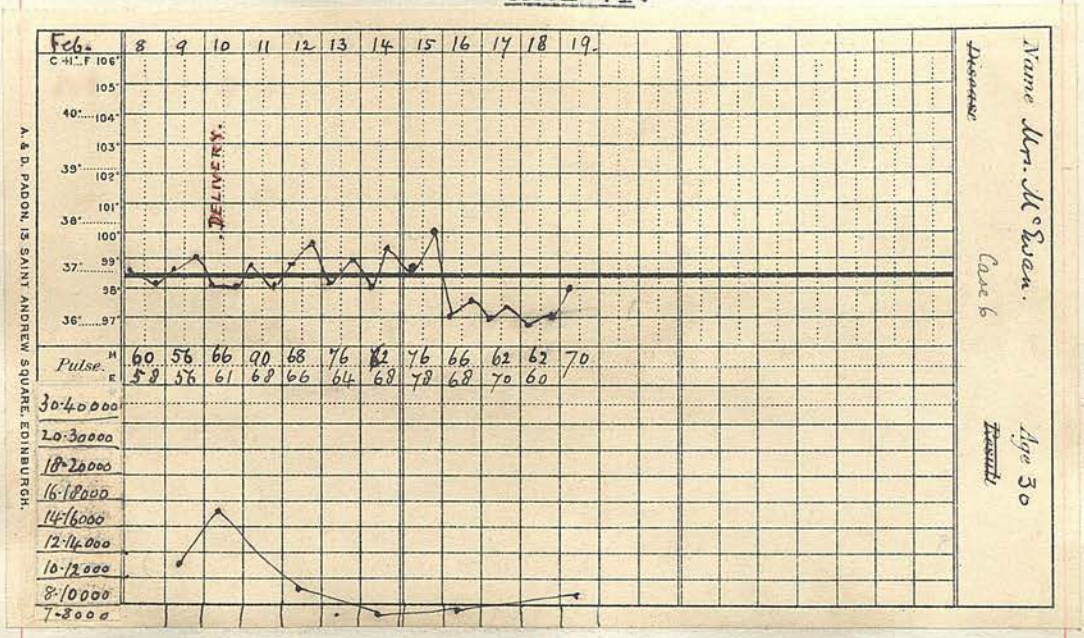


Patient was a half caste multipara. The labour and puerperium were perfectly natural. The child was a small one only weighing 5 lbs. 13 oz. The first blood count was made on the day before delivery and is seen to rise on the day of delivery very slightly.

The actual counts were as follows:----

Feb. 11th.	16250.	Per cubic	Millimeter.	(Before delivery).
" 12th.	17187.	"	" Millimeter.	(Day of delivery).
" 13th.	16250.	"	" Millimeter.	
" 14th.	14687.	"	" "	
" 17th.	8750.	"	" "	
" 20th.	7812.	"	" "	

CASE VI.

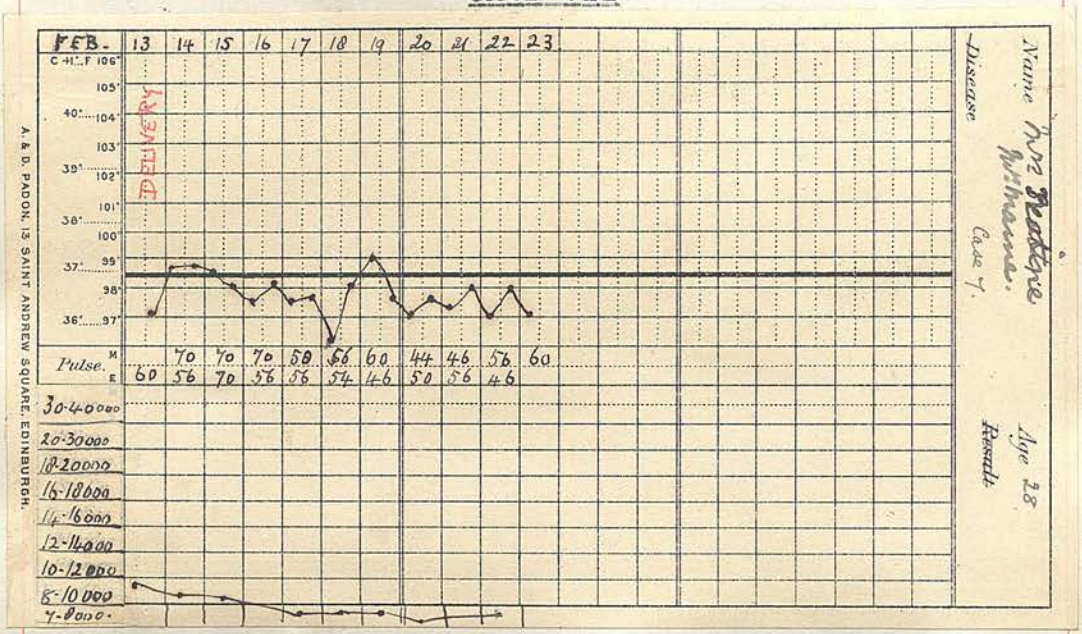


This patient was a III para. The perineum which had been torn in a previous labour was torn again and three stitches were necessary. The rise of temperature on the 15th was evidently due to a loaded rectum, for after a copious enemia, the temperature dropped on 16th and remained subnormal. It is interesting to know that there was no corresponding rise in the pulse or in the leucocyte curve.

The actual counts were:----

Feb. 9th.	10625.	Per cubic	millimeter. (Before delivery).
" 10th.	15625.	"	"	millimeter. (Day of delivery).
" 12th.	9687.	"	"	millimeter.
" 14th.	7187.	"	"	"
" 16th.	7812.	"	"	"
" 19th.	8125.	"	"	"

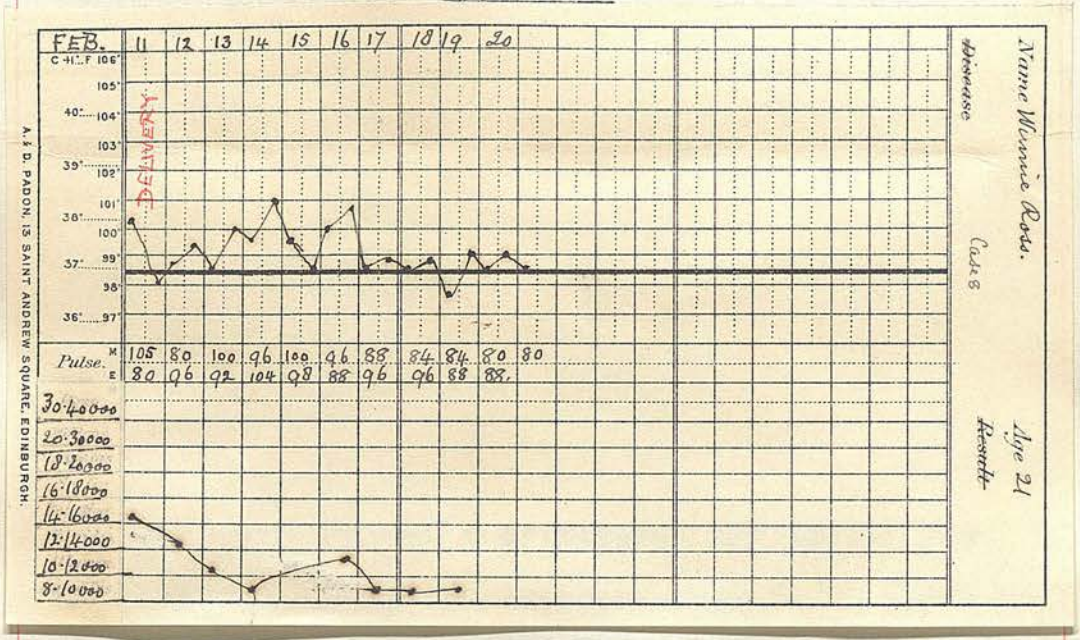
CASE VII.



This patient was a VII para, the labour was natural and easy and the puerperium quite normal. The blood count was persistently low and was as follows:----

Feb.	13th.	9375.	Per cubic millimeter.	
"	14th.	8750.	"	"
"	15th.	8125.	"	"
"	17th.	7812.	"	"
"	19th.	7812.	"	"
"	20th.	6250.	"	"
"	22nd.	7500.	"	"

CASE VIII.



artificially, delay still continuing, forceps were resorted to.

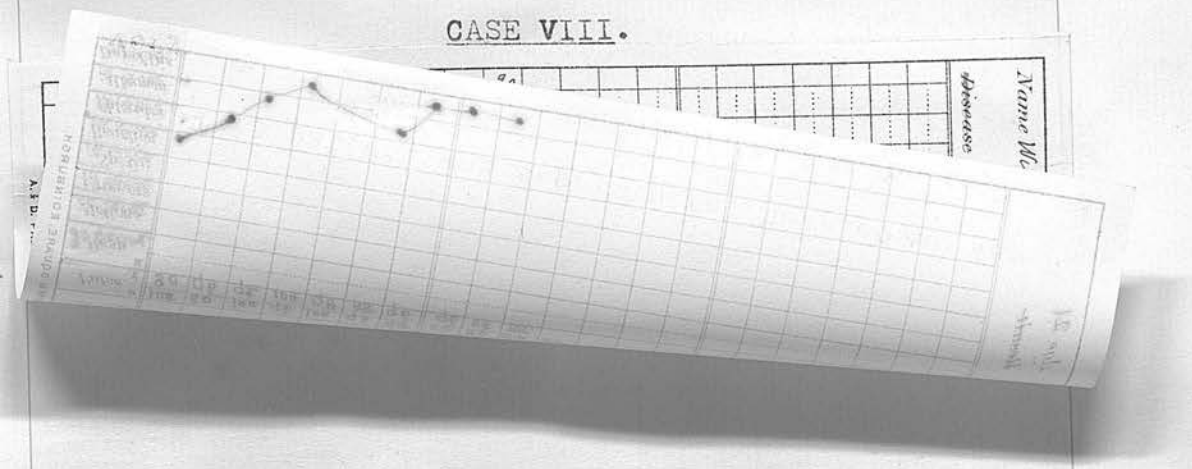
During the puerperium the patient had very tender breasts, both of which became covered with small pustules.

There was a rise of 1000 per cub. m.m. in the leucocyte count on the 16th, which may be explained by the breast condition.

The actual counts were:----

Feb.	11th.	14062.	Per cubic millimeter.	
"	12th.	12187.	"	"
"	13th.	10,000.	"	"
"	15th.	9162.	"	"
"	16th.	10625.	"	"
"	17th.	9375.	"	"
"	18th.	8125.	"	"
"	19th.	8750.	"	"

CASE VIII.



This patient was a primipara, her labour was very laborious, and the membranes had to be ruptured artificially, delay still continuing, forceps were resorted to.

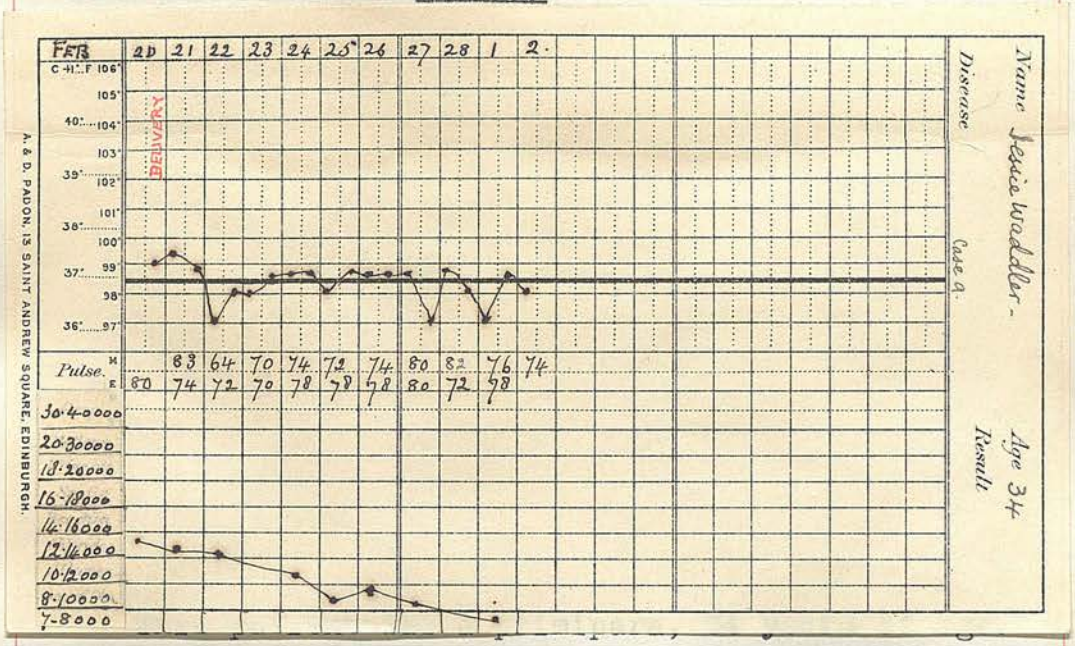
During the puerperium the patient had very tender breasts, both of which became covered with small pustules.

There was a rise of 1000 per cub. m.m. in the leucocyte count on the 16th, which may be explained by the breast condition.

The actual counts were:----

Feb.	11th.	14062.	Per cubic millimeter.	
"	12th.	12187.	"	"
"	13th.	10,000.	"	"
"	15th.	9162.	"	"
"	16th.	10625.	"	"
"	17th.	9375.	"	"
"	18th.	8125.	"	"
"	19th.	8750.	"	"

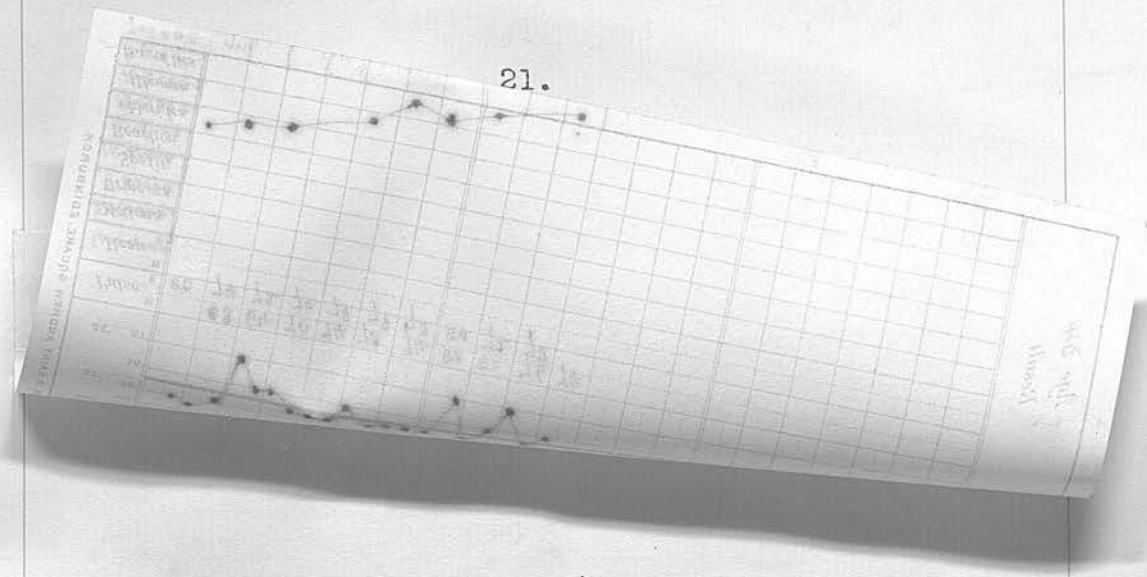
CASE IX.



There was delay in the second stage and the labour was assisted by means of forceps. Three stitches were necessary in the perineum. The puerperium was perfectly normal.

The counts made were:----

Feb.	20th.	13750.	Per	cubic	millimeter.
"	21st.	13125.	"	"	"
"	22nd.	12500.	"	"	"
"	24th.	10312.	"	"	"
"	25th.	8437.	"	"	"
"	26th.	9162.	"	"	"
"	27th.	8750.	"	"	"
March	1st.	7812.	"	"	"

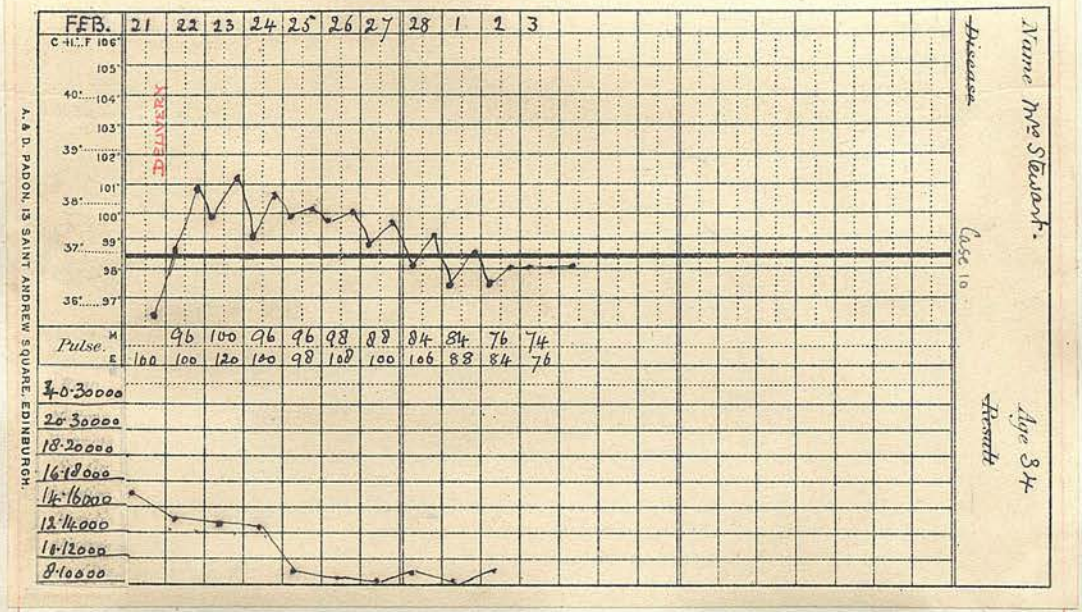


This patient was a primipara, 34 years of age. There was delay in the second stage and the labour was assisted by means of forceps. Three stitches were necessary in the perineum. The puerperium was perfectly normal.

The counts made were:----

Feb.	20th.	13750.	Per	cubic	millimeter.
"	21st.	13125.	"	"	"
"	22nd.	12500.	"	"	"
"	24th.	10312.	"	"	"
"	25th.	8437.	"	"	"
"	26th.	9162.	"	"	"
"	27th.	8750.	"	"	"
March	1st.	7812.	"	"	"

CASE X.

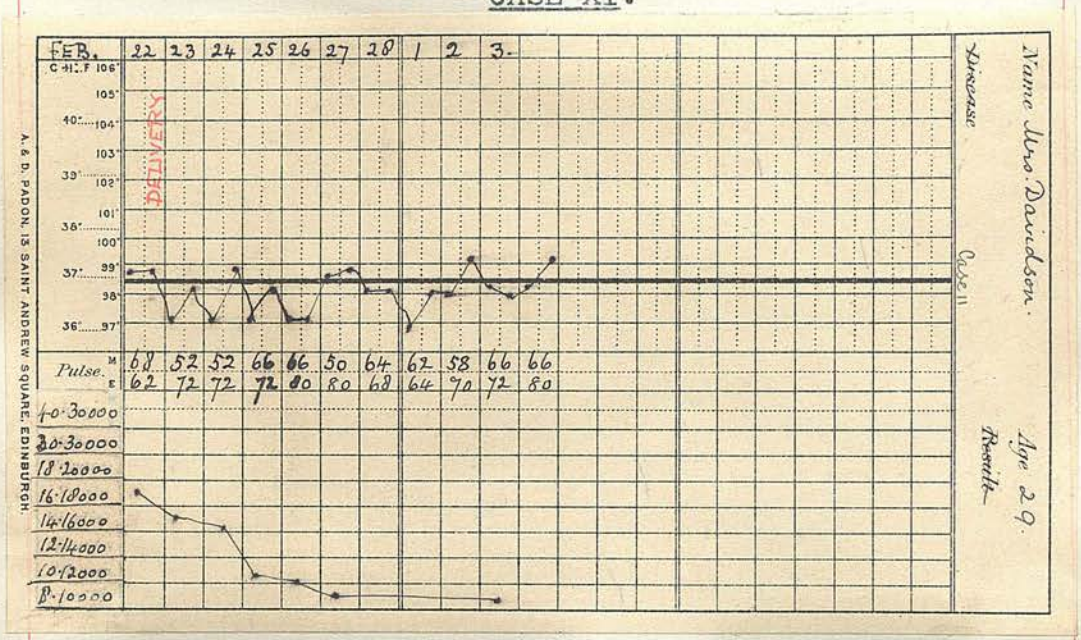


Patient was a VII. para; labour pains came on at the 6th month with some ante-partum haemorrhage, which was found to be due to a marginal placenta proevia. A macerated foetus weighing 3 lbs was delivered, breech first. The pulse and temperature were above normal and the lochia were never the least offensive. The leucocyte count dropped on the 5th day and remained below for the rest of the puerperium, the temperature coming down by lysis.

The counts were:----

Feb.	21st	14375.	Per cubic millimeter.
"	22nd	13750.	" " "
"	24th	12500.	" " "
"	25th	9375.	" " "
"	26th	9162.	" " "
"	27th	8750.	" " "
"	28th	9162.	" " "
March	2nd	8750.	" " "
"	3rd	9162.	" " "

CASE XI.

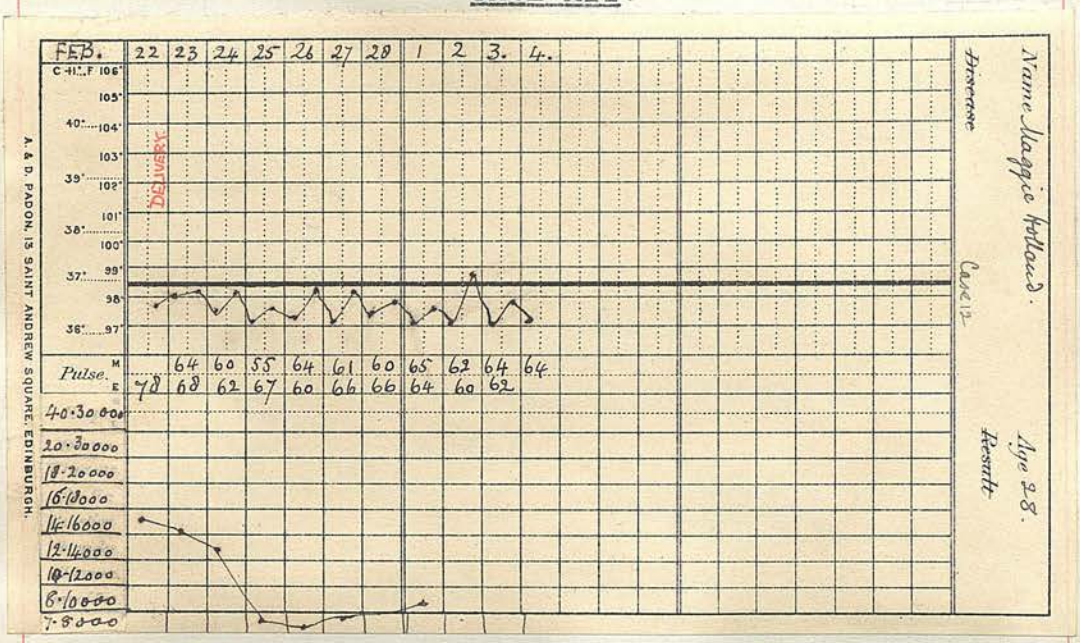


This patient was a II para. Her labour and puerperium were perfectly normal.

The counts made were:-----

Feb.	22nd.	16250.	Per	cubic	millimeter.
"	23rd.	15000.	"	"	"
"	24th.	14375.	"	"	"
"	25th.	10937.	"	"	"
"	26th.	10000.	"	"	"
"	27th.	9375.	"	"	"
March	3rd.	8125.	"	"	"

CASE XII.

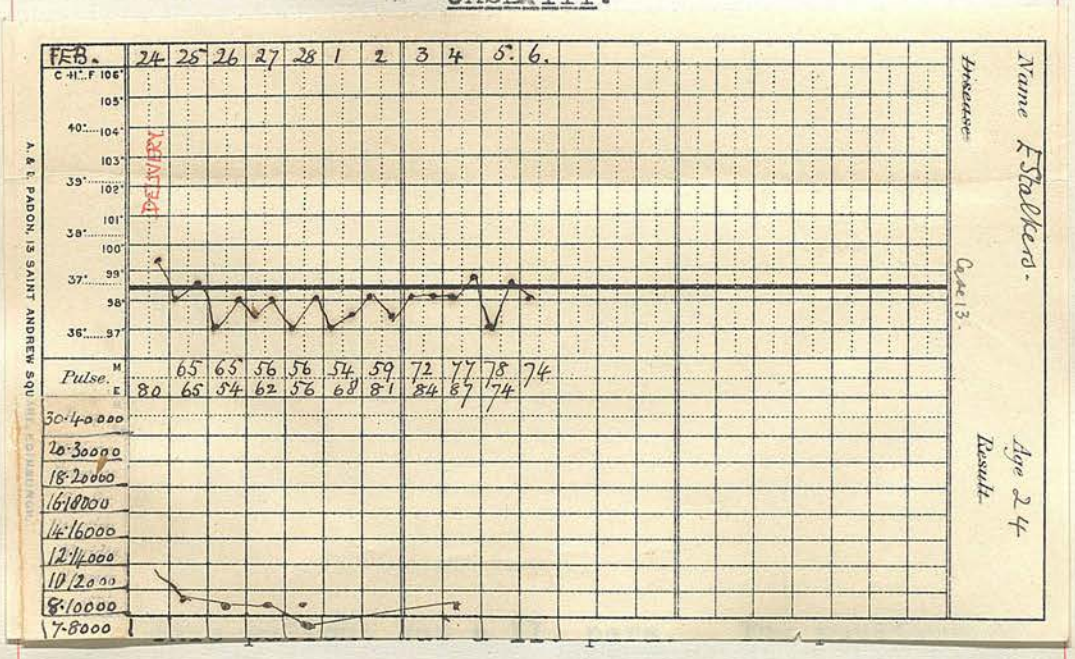


This patient was a III para. Both labour and puerperium were perfectly normal. This case compares well with the preceding one (No.11), who was also a III para.

The counts made were:----

Feb.	22nd.	15,000.	Per cubic millimeter.	
"	23rd.	14,062.	"	"
"	24th.	12,812.	"	"
"	25th.	7812.	"	"
"	26th.	7817.	"	"
"	27th.	7812.	"	"
March	1st.	8437.	"	"

CASE XIII.

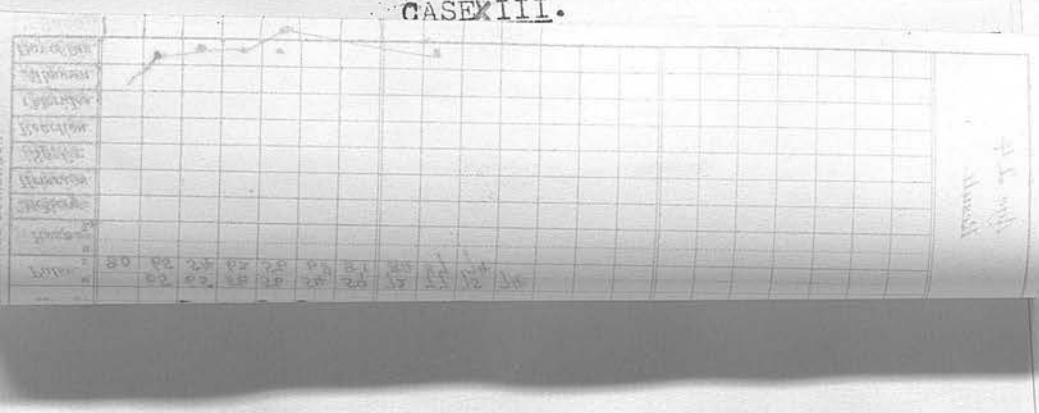


the child's head was right occipito posterior, consequently the labour was rather a long one and the perineum gave way requiring two stitches. The puerperium was normal.

The counts made were:----

Feb.	25th.	9375.	Per	cubic	millimeter.
"	26th.	8437.	"	"	"
"	27th.	8125.	"	"	"
"	28th.	7812.	"	"	"
March	4th.	8750.	"	"	"

CASE XIII.

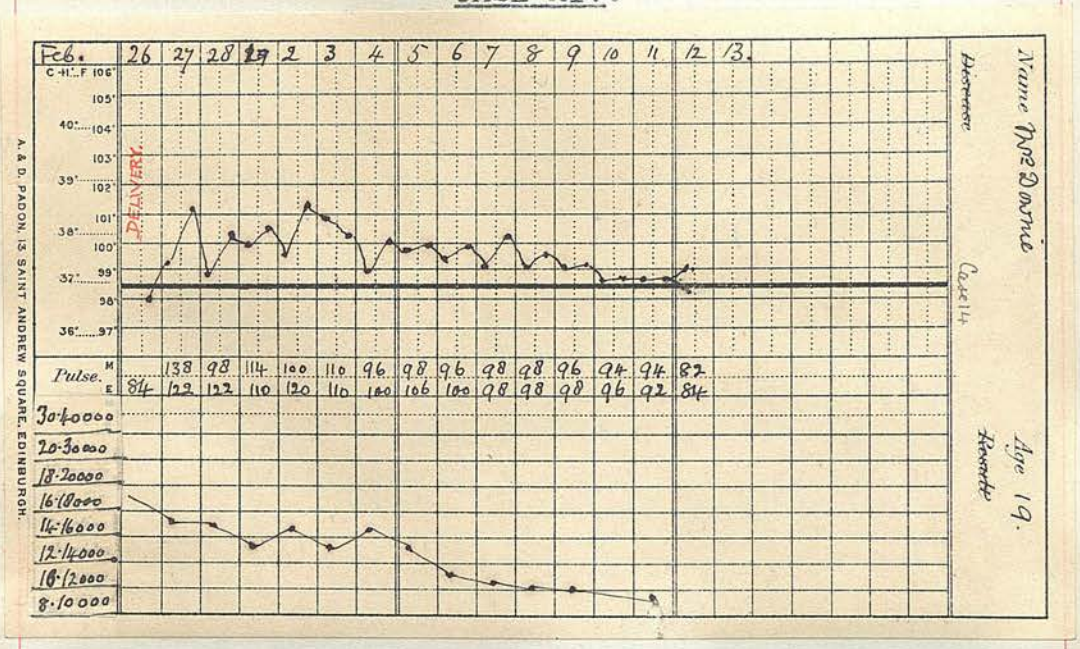


This patient was a II. para. The position of the child's head was right occipito posterior, consequently the labour was rather a long one and the perineum gave way requiring two stitches. The puerperium was normal.

The counts made were:----

Feb.	25th.	9375.	Per cubic millimeter.
"	26th.	8437.	" " "
"	27th.	8125.	" " "
"	28th.	7812.	" " "
March	4th.	8750.	" " "

CASE XIV.



This case was one of a primipara aged 19, who was admitted in an unconscious condition, with oedema of legs and face. For a week or two before admission she had suffered from severe headache and flashes of light in the eyes, but had never thought it necessary to consult a medical man for this or the oedema, which was appearing about her face, hands and legs, etc. On Feb. 26th, she had three fits of convulsive character and was brought to the Royal Maternity Hospital absolutely unconscious. A vaginal examination was made and it was found that she was not in labour. She was given ¼ gr. morphia, and placed in a hot pack, also having castor oil administered and an enema. A catheter specimen of urine/

urine was found to be nearly "solid" with albumin on boiling.

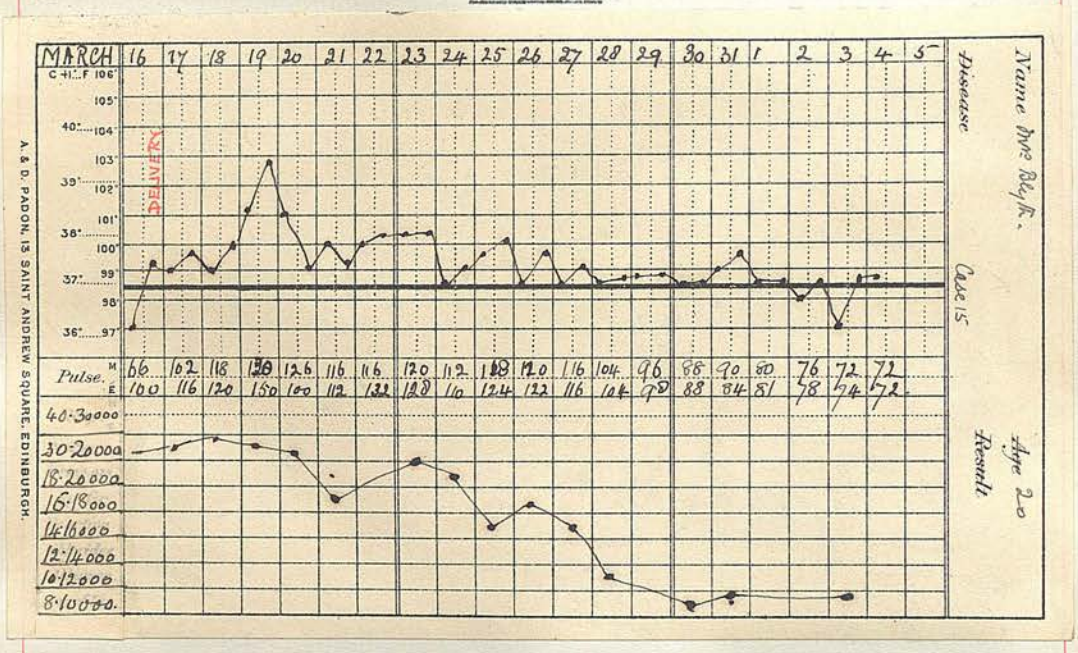
In an hour's time she had a fit followed by another 20 minutes later. Chloroform was given, but it was decided to terminate the pregnancy. The Cervix was therefore dilated with Bossi's Dilator and forceps applied to the head, but the cervix contracted a little and so version was resorted to.

For the first week of the puerperium, the patient had some oedema of the lungs, but this cleared rapidly away as also did the oedema elsewhere, and the Albumin in the Urine. The patient made a very good recovery, without any of return of the convulsions. The daily examination of the blood showed a high count, slightly irregular, for the first week after this it dropped, but did not reach 10,000 per cubic millimeter before the twelfth day. Vide case 46. It is interesting to note that the drop in the Blood count accompanied the drop in the pulse rate more than that of the Temperature.

The counts made were:----

Feb.	27th.	15625.	Per	cubic	millimeter.
"	28th.	15312.	"	"	"
March	1st.	14687.	"	"	"
"	2nd.	15000.	"	"	"
"	3rd.	14062.	"	"	"
"	4th.	15000.	"	"	"
"	5th.	14375.	"	"	"
"	6th.	12187.	"	"	"
"	7th.	11875.	"	"	"
"	8th.	10937.	"	"	"
"	9th.	10000.	"	"	"
"	11th.	9375.	"	"	"

CASE XV.



This case was another of a primipara aged 20, who was brought to the Hospital in a comatose condition, following on four eclamptic fits at home. Her previous history is interesting. Up till fifteen months ago she had been perfectly well. Just before this time she was married and soon had a slight attack of Rheumatic Fever, lasting about a month and followed by Chorea, for which she was admitted to the Royal Infirmary, where she remained for two weeks. The Choreiform movements lasted altogether about 6 weeks. At the end of this time her menstruation hitherto regular, ceased, and she dated her pregnancy from this time. The morning sickness though never severe lasted throughout the pregnancy. She was apparently perfectly well up/

up to two months before admission to the Maternity Hospital, when she noticed that her eyes and face were slightly swollen, also her legs at night, and that she was passing rather less urine per diem. Two weeks before admission she consulted a doctor about a pain in her back and side and also about the oedema of extremities and face. He examined her urine and told her that it was in a very bad condition and gave her instructions about her diet etc., to which she does not appear to have paid much attention. The diminution in the quantity of urine and the oedema became more marked. This culminated on March 16th in the patient , having while at home four eclamptic fits, following the last of which she was brought to the Simpson Memorial Hospital in a comatose condition. She was a large well made woman, with much oedema of face and hands and legs and body generally, and found not to be in labour. She was given ¼ gr. of morphia, hypodermically. Being just able to swallow, she was also given 20 grains of Pulv. Jalapae Co: with 3 grains of Pulv. Elaterini Co: Two pints of Saline were injected into the breasts and she was placed in a Hot Pack. Ten ounces of urine having previously been withdrawn, this was found

to/

to be loaded with Albumin and characteristic of Eclampsia. Another Eclamptic seizure followed, and was treated with a further injection of ¼ grain of Morphia and 2 more pints of Saline into the breast tissue and Chloroform administered. Eight hours after admission 33 ounces of urine were drawn off and found to contain 18 grains of Albumin per pint. Another fit beginning to come on, it was decided to bring on premature labour and the cervix was therefore dealt with by Bossi's Dilator. When apparently dilated the instrument was withdrawn, but it was found that the cervix contracted spasmodically, again too rapidly to allow of delivery. The patient was therefore put back to bed and Chloral and Bromide administered. Three hours later another fit appeared, and Bossi's Dilator was again resorted to, this time successfully, and a still born child delivered by means of forceps. There was a good deal of post-partum haemorrhage and two pints of Saline Solution were again introduced into the breast tissue. During the 17th, 18th, and 19th, patient was semi-comatose, just able to swallow a little nourishment. The pulse was rapid and bounding and on 19th the temperature in the evening reached 102.8. During these days the Urine drawn off/

off increased in quantity but contained 21 grs. 17 grs. and 20 grs. of Albumin per pint respectively. The Urea only amounting to 130 grs. per diem, till 19th, when 300 grains were passed, and the patient then was in a semi-comatose condition with sighing respirations.

On the 20th a change occurred; the temperature and pulse were lower, so also the blood count, as will be seen on the chart and the patient gradually returned to consciousness. The Urine contained less Albumin, 12 grains per pint, and the Urea increased to 380 grains. There was some dulness at the Right base with fine crepitations and increased Vocal Resonance, but no cough.

On 21st, consciousness was thoroughly established. The Albumin dropped to 10 grains per pint. The dulness over right lung was very pronounced and distant tubular breathing was heard.

On the 23rd, there was only a trace of Albumin and patient was in every way much improved. By the 28th, the lung condition had cleared up, but though the Urea had reached 500 grs. per diem, the Albumin went up to 15 grs. per pint again. On the 31st it was still 10 grains per pint, and so on the 5th of April, patient was removed to Chalmers Hospital/

Hospital on account of the permanent damage to her kidneys.

With regard to the involution of the Uterus, it was perfectly normal and the lochia correct in quantity and quality. This case contrasts well with the former one which was an uncomplicated one of Eclampsia, and so I have thought it well to set down rather more fully than I intended the details of the history and puerperium of the case. It will be seen that the leucocyte count was higher from the beginning than that of the preceding Eclamptic Case, and that it was maintained for a much longer period. This is accounted for possibly to some extent by the lung complications.

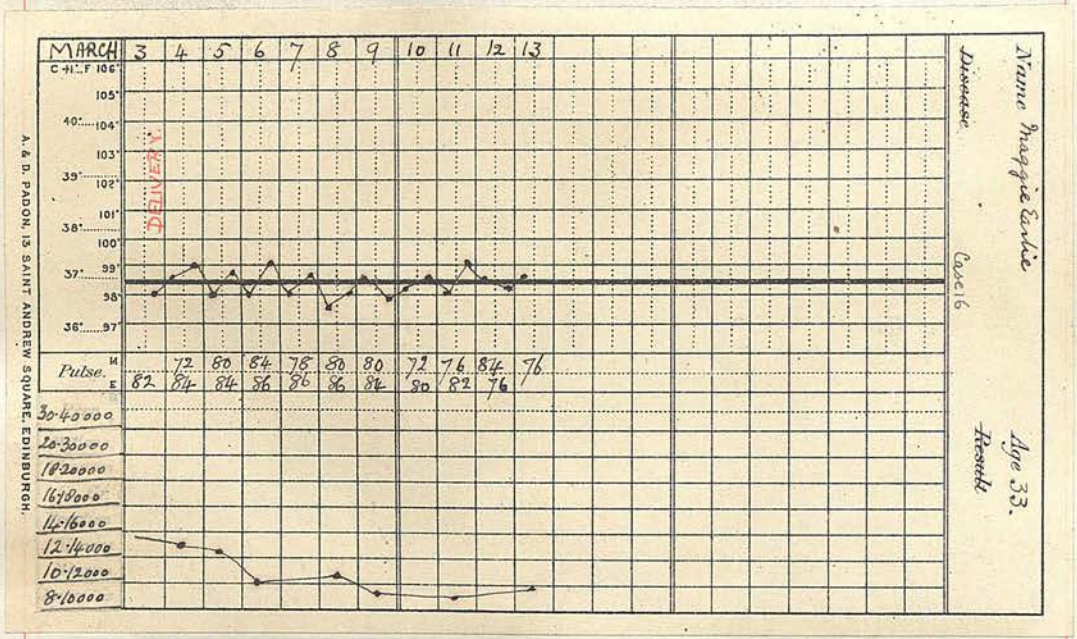
It is interesting to note how the leucocyte count dropped from 21,250 per cub. m.m. to 17500 per cub. m.m. on the 6th day, that being the day when the patient was so palpably better. It rose again the following day and remained fairly high till 28th March, when the lung condition had cleared, then falling to 11,250 per cubic millimeter.

The actual counts were:-----

March	17th.	27500.	Per cubic	millimeter.
"	18th.	29062.	"	" "
"	19th.	26875.	"	" "
"	20th.	21250.	"	" "
"	21st.	17500.	"	" "
"	23rd.	20625.	"	" "
"	24th.	18750.	"	" "
"	25th.	14375.	"	" "
"	26th.	16250.	"	" "
"	27th.	15000.	"	" "
"	28th.	11250.	"	" "
"	30th.	8750.	"	" "
"	31st.	9162.	"	" "
April	3rd.	9162.	"	" "

This case then is extremely instructive in showing how complications in the Puerperium will influence the Leucocyte count.

CASE XVI.

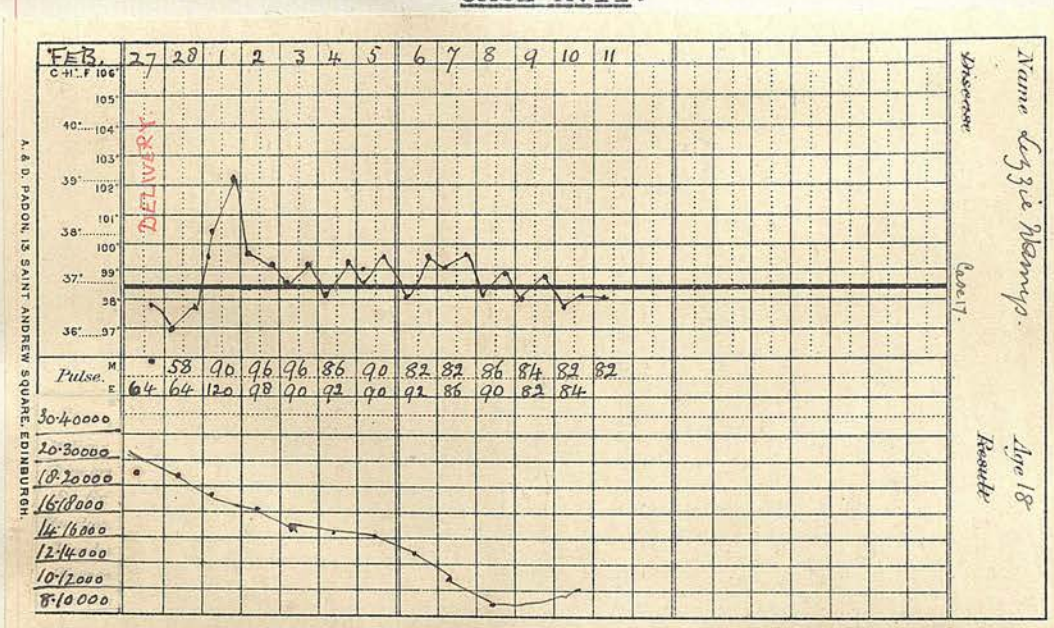


This patient was a IV para. Her labour and puerperium were normal.

The counts made were:----

March 4th.	13125.	Per	cubic	millimeter.
" 5th.	12500.	"	"	"
" 6th.	10000.	"	"	"
" 8th.	10625.	"	"	"
" 9th.	9375.	"	"	"
" 11th.	8750.	"	"	"
" 13th.	9162.	"	"	"

CASE XVII.

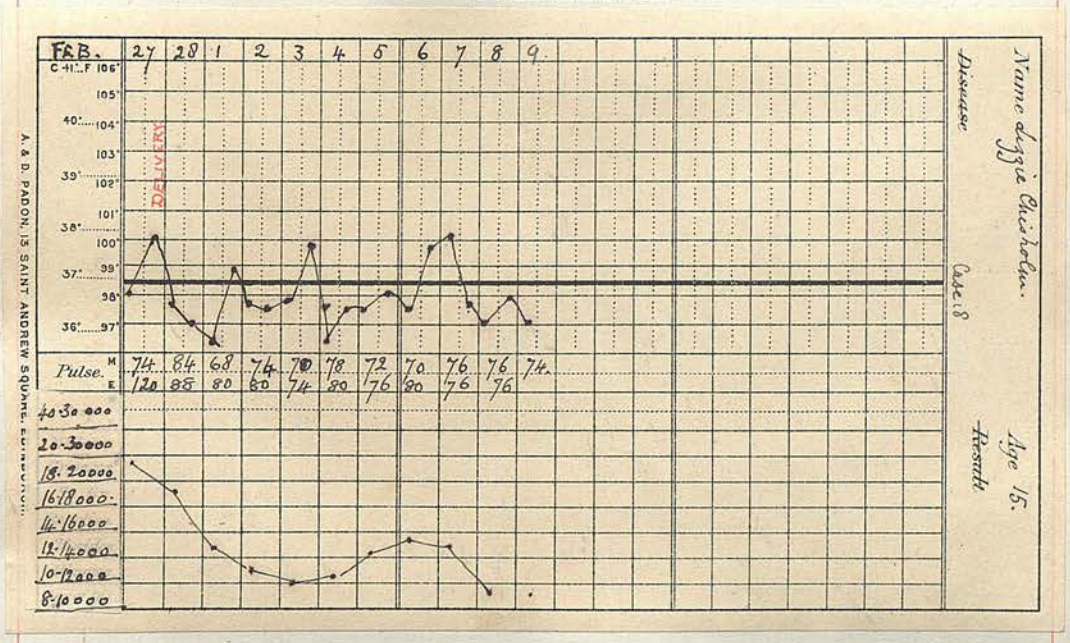


This patient was a primipara. She had gonorrhaeal vaginities and her lochia were offensive. The leucocyte count is seen in this to remain unusually high throughout the first 9 days of the puerperium.

The actual counts made were:----

Feb.	28th.	18437.	Per	cubic	millimeter.
March	1st.	17187.	"	"	"
"	2nd.	16250.	"	"	"
"	3rd.	15625.	"	"	"
"	4th.	15000.	"	"	"
"	5th.	14375.	"	"	"
"	6th.	12500.	"	"	"
"	7th.	10312.	"	"	"
"	9th.	9375.	"	"	"

CASE XVIII.



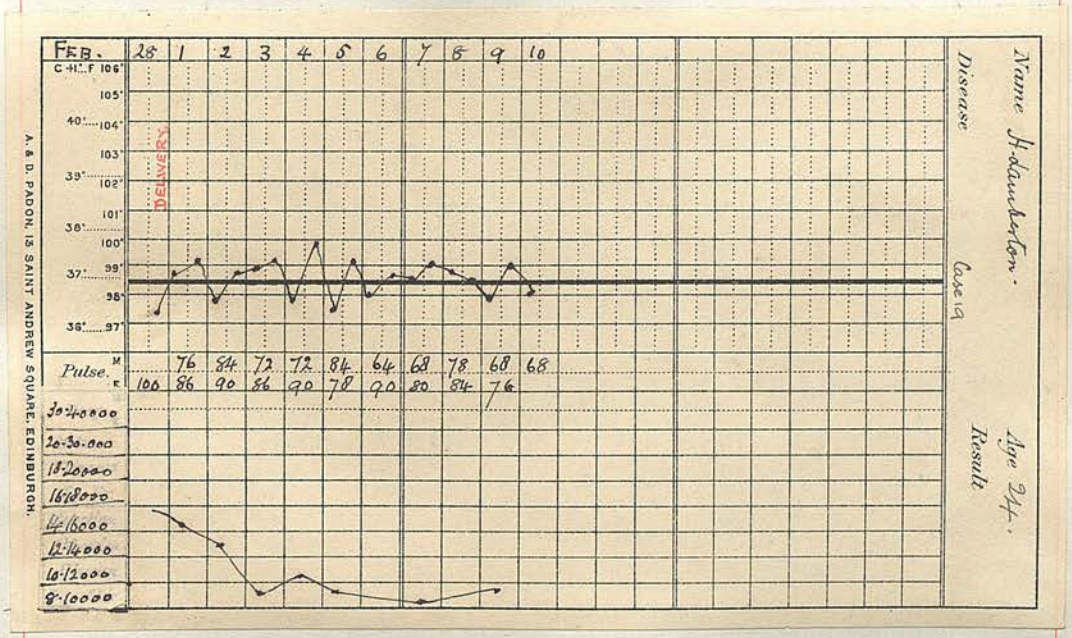
This patient was a primipara. The labour was a natural one, and both placenta and membranes were expelled intact. The lochia, however, became extremely offensive and the temperature touched 100 several times; the pulse, however, remained normal.

The blood count dropped to 10,000 on the 5th day, but rose again. It would seem as if the sustained rise on the 7th, 8th and 9th days had some relation to the very offensive lochia.

The counts were as follows:----

Feb.	27th.	19062.	Per cubic	millimeter.
"	28th.	17812.	" "	"
March.	1st.	12500.	" "	"
"	2nd.	11875.	" "	"
"	3rd.	10000.	" "	"
"	4th.	10625.	" "	"
"	5th.	12812.	" "	"
"	6th.	13750.	" "	"
"	7th.	13125.	" "	"
"	8th.	8750.	" "	"

CASE XIX.



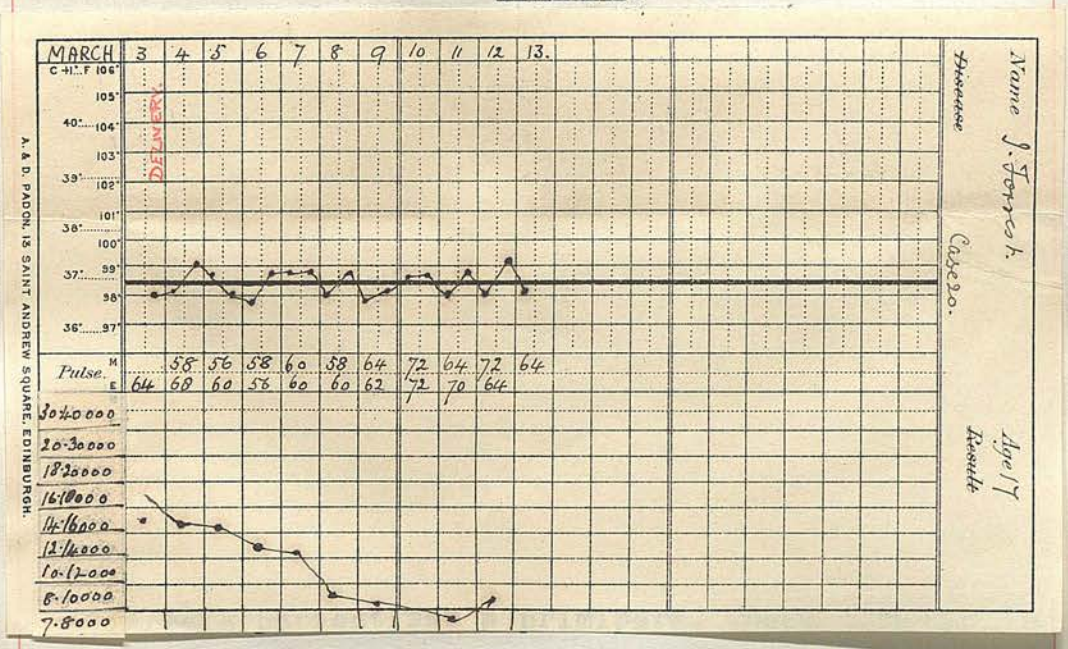
This patient was a primipara. The labour was laborious and had to be assisted by means of Forceps. The placenta was partially adherent and had to be artificially removed. Two stitches were necessary in the perineum. During the puerperium the lochia were slightly offensive and though there was some irregularity of the temperature, the pulse remained quiet.

The leucocyte count corresponds more with the pulse than with the temperature.

The counts made were:----

March	1st.	14375.	Per cubic	millimeter.
"	2nd.	13750.	" "	"
"	3rd.	9375.	" "	"
"	4th.	10375.	" "	"
"	5th.	9375.	" "	"
"	7th.	8437.	" "	"
"	9th.	9375.	" "	"

CASE XX.

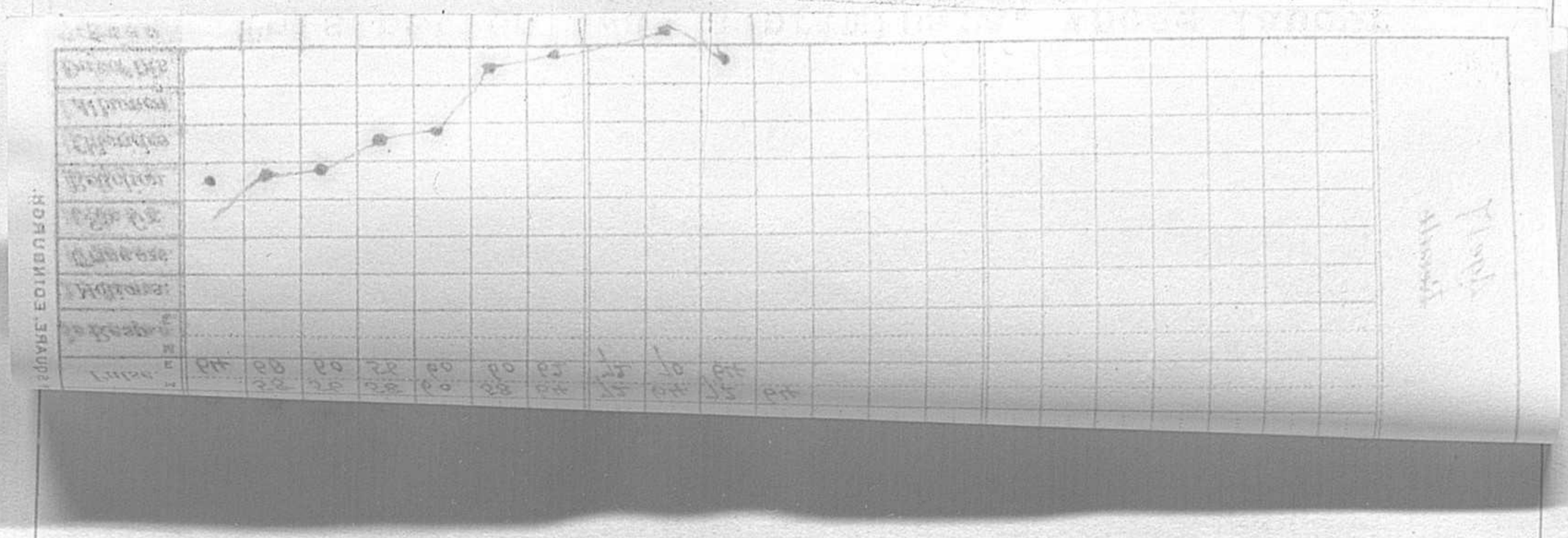


and puerperium were perfectly normal.

The actual counts made were:-----

March	4th.	15000.	Per cubic	millimeter.
"	5th.	14375.	" "	"
"	6th.	13750.	" "	"
"	7th.	12500.	" "	"
"	8th.	9687.	" "	"
"	9th.	8437.	" "	"
"	11th.	7812.	" "	"
"	12th.	8125.	" "	"

CASE XX.

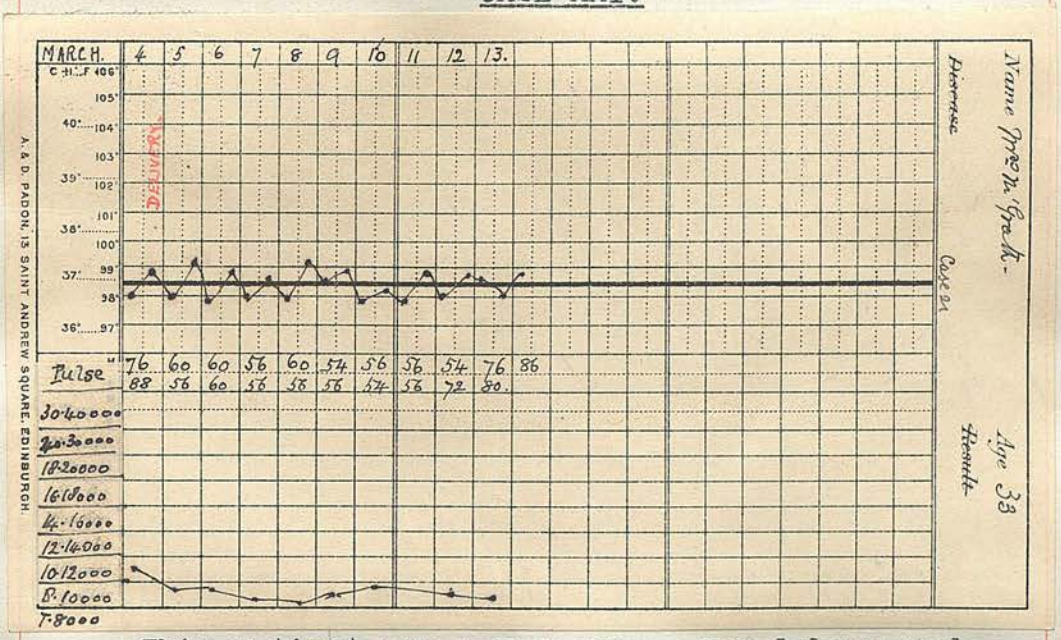


This patient was a primipara, whose labour and puerperium were perfectly normal.

The actual counts made were:-----

March 4th.	15000.	Per cubic millimeter.	
" 5th.	14375.	"	" "
" 6th.	13750.	"	" "
" 7th.	12500.	"	" "
" 8th.	9687.	"	" "
" 9th.	8437.	"	" "
" 11th.	7812.	"	" "
" 12th.	8125.	"	" "

CASE XXI.

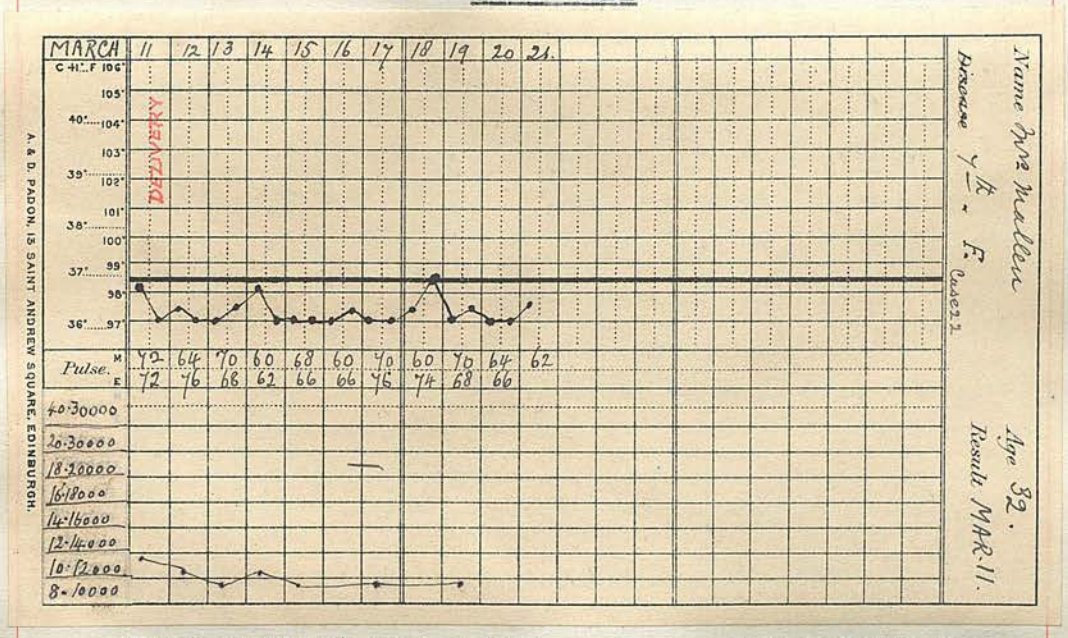


This patient was a V. para. Her labour and puerperium perfectly normal. It is interesting to see on the day of delivery she had a leucocyte count, of only 10625 and that this dropped on the following day and practically remained the same throughout the 10 days of the puerperium.

The counts made were:----

March	4th.	10625.	Per cubic	millimeter.
"	5th.	9687.	" "	"
"	6th.	9687.	" "	"
"	7th.	8750.	" "	"
"	8th.	8125.	" "	"
"	9th.	8437.	" "	"
"	11th.	9375.	" "	"
"	12th.	8750.	" "	"
"	13th.	7500.	" "	"

CASE XXII.



This patient was a VII. para. Her labour and puerperium were quite normal. The case in every way resembles that of Case 21. The leucocyte count corresponds also very fairly with that case.

The counts made were:----

March 7th. 8437. Per cubic millimeter. (Before delivery).

" 8th. 9375. " " millimeter.

" 11th. 10937. " " " (After delivery).

" 12th. 10312. " " millimeter.

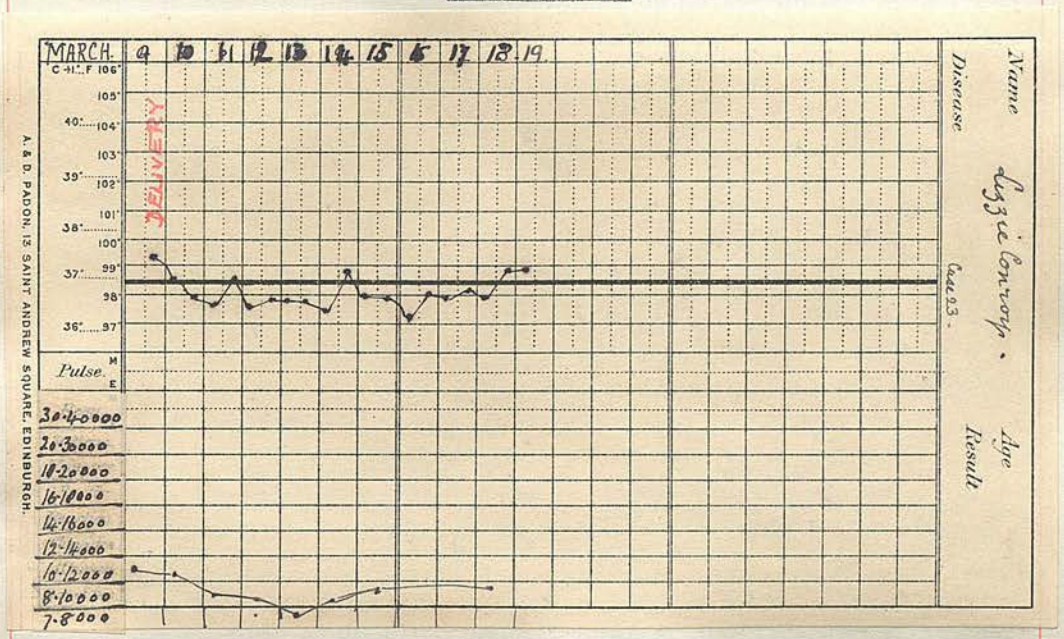
" 13th. 9687. " " "

" 14th. 10937. " " "

" 17th. 9375. " " "

" 19th. 9375. " " "

CASE XXIII.

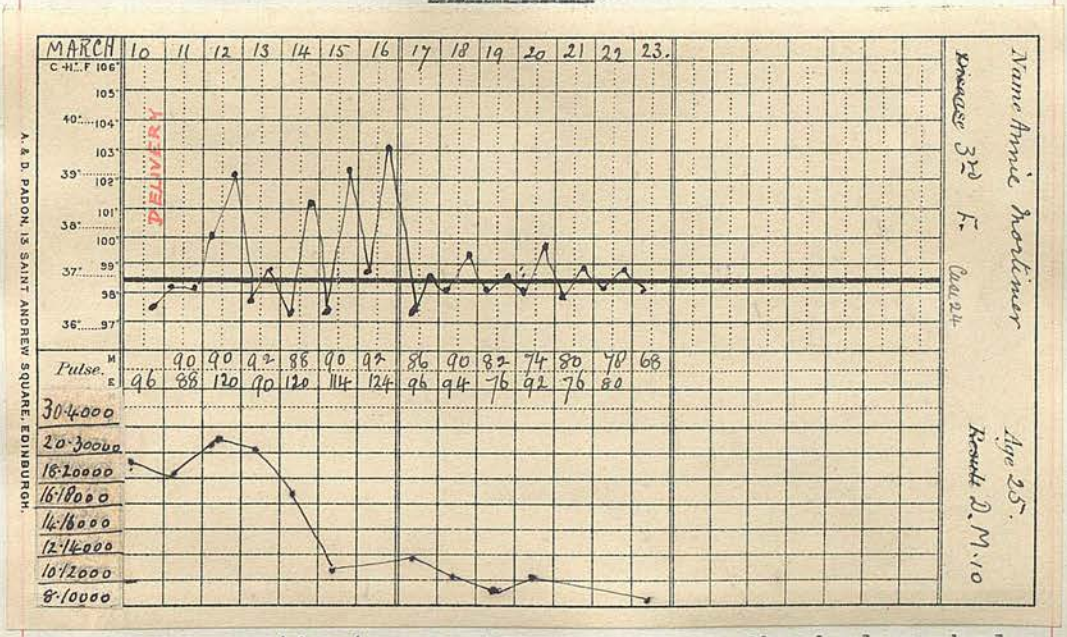


This patient was a primipara, anaemic, badly nourished and below par in her general health, with a normal labour and puerperium, and corresponds very closely with the preceding cases (Nos. 21 & 22), who, however, were multiparae. The comparatively low counts here may possibly be accounted for by her general condition.

The counts made were:----

Feb.	9th.	11250.	Per	cubic	millimeter.
"	10th.	10937.	"	"	"
"	11th.	9375.	"	"	"
"	12th.	8437.	"	"	"
"	13th.	7812.	"	"	"
"	14th.	8750.	"	"	"
"	15th.	9162.	"	"	"
"	18th.	9375.	"	"	"

CASE XXIV.



This patient was a III. para. She had marked mitral regurgitation. Her pelvis was very slightly flattened. Forceps extraction was necessary. On the 12th, she developed a small patch of dry pleurisy on the right side which spread rapidly but never gave rise to fluid. It is interesting to note how the leucocyte count coincidently rose above that on the day of delivery, remained high for three days and then sank but did not go below 10,000 till the 10th day. In this case then, we find a leucocytosis quite apart from the leucocytosis of the pregnancy and evidently due to the Inflammation of the pleura.

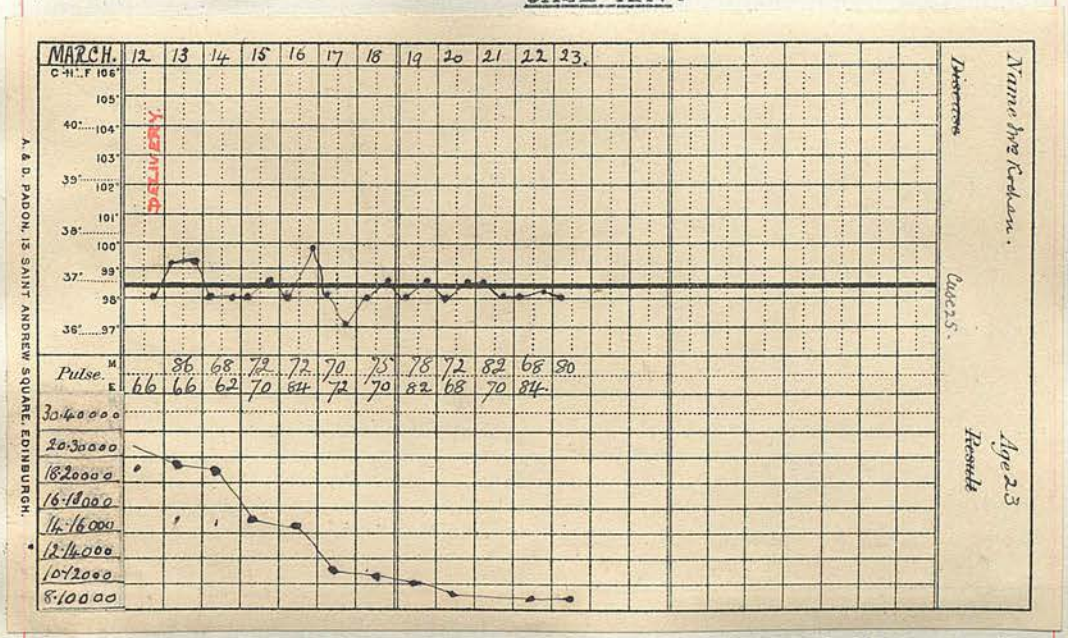
It is interesting also to note that in spite of the rise in the temperature and pulse rate on the 16th/

16th, we find no indications of a corresponding leucocytosis, though the subsequent history of the case indicates that the inflammation of the pleura was then subsiding.

The counts made are as follows:----

March 9th.	16562.	Per cubic millimeter. (Before delivery).		
" 10th.	19062.	"	"	millimeter. (After delivery)
" 11th.	18750.	"	"	"
" 12th.	21875.	"	"	"
" 13th.	20312.	"	"	"
" 14th.	16875.	"	"	"
" 15th.	11875.	"	"	"
" 17th.	12500.	"	"	"
" 18th.	10312.	"	"	"
" 19th.	9375.	"	"	"
" 20th.	10000.	"	"	"
" 23rd.	8750.	"	"	"

CASE XXV.

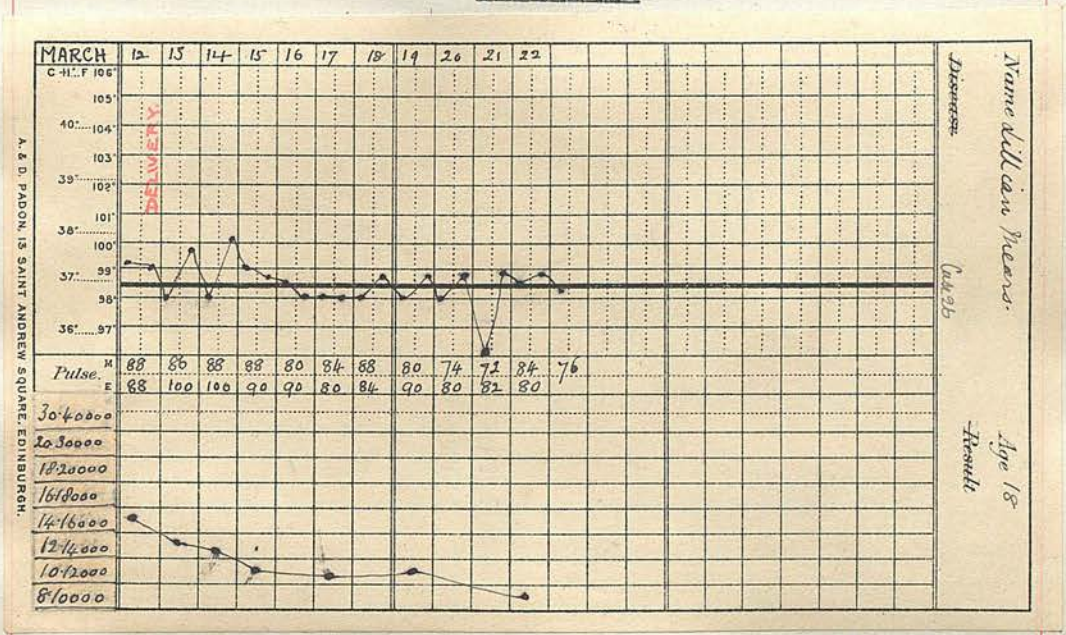


This patient was a primipara. Her labour and puerperium were perfectly normal. The leucocyte count was somewhat high to start with but dropped on the fourth day and remained down for the rest of her term in Hospital.

The counts made were:----

March	13th.	17187.	Per cubic	millimeter.
"	14th.	15937.	"	"
"	15th.	15212.	"	"
"	16th.	13125.	"	"
"	17th.	11875.	"	"
"	18th.	10312.	"	"
"	19th.	10000.	"	"
"	20th.	9687.	"	"
"	22nd.	9375.	"	"

CASE XXVI.

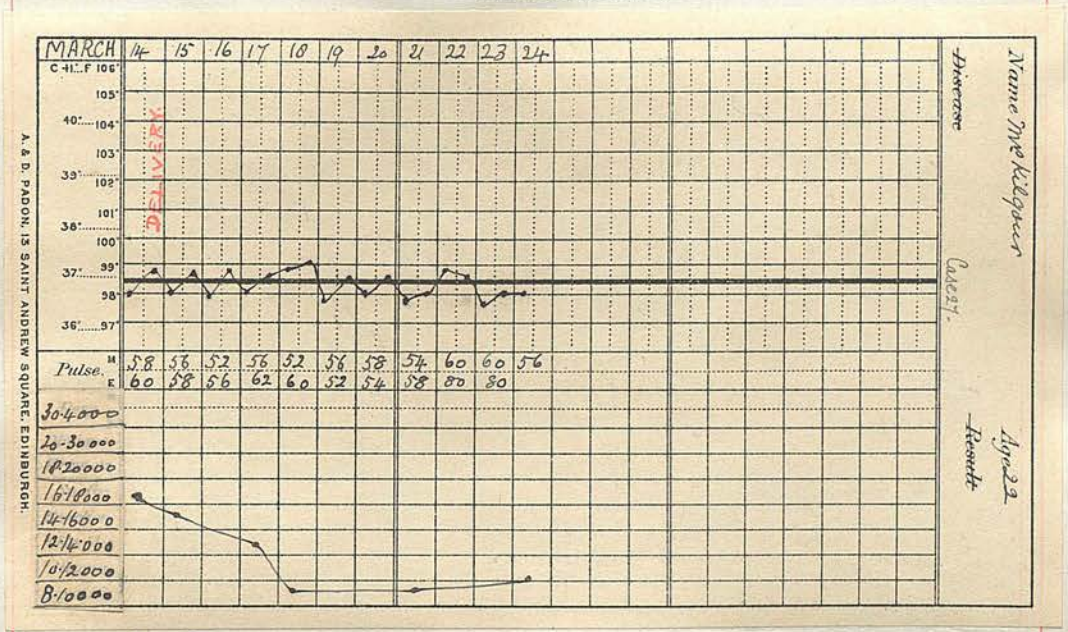


This patient was a primipara whose labour was perfectly normal. The temperature rose to 100 on night of the second day of the puerperium but dropped after a dose of Calomel and an enema, so that the rise was probably due to a loaded rectum. The leucocyte count was unaffected.

The counts were:----

March 11th	13750.	Per cubic millimeter.	(Before delivery)
" 12th	14062.	" " millimeter.	(Day of delivery).
" 13th	12812.	" " millimeter.	
" 14th	12187.	" " "	
" 15th	12500.	" " "	
" 17th	11875.	" " "	
" 19th	12187.	" " "	
" 22nd	9687.	" " "	

CASE XXVII.

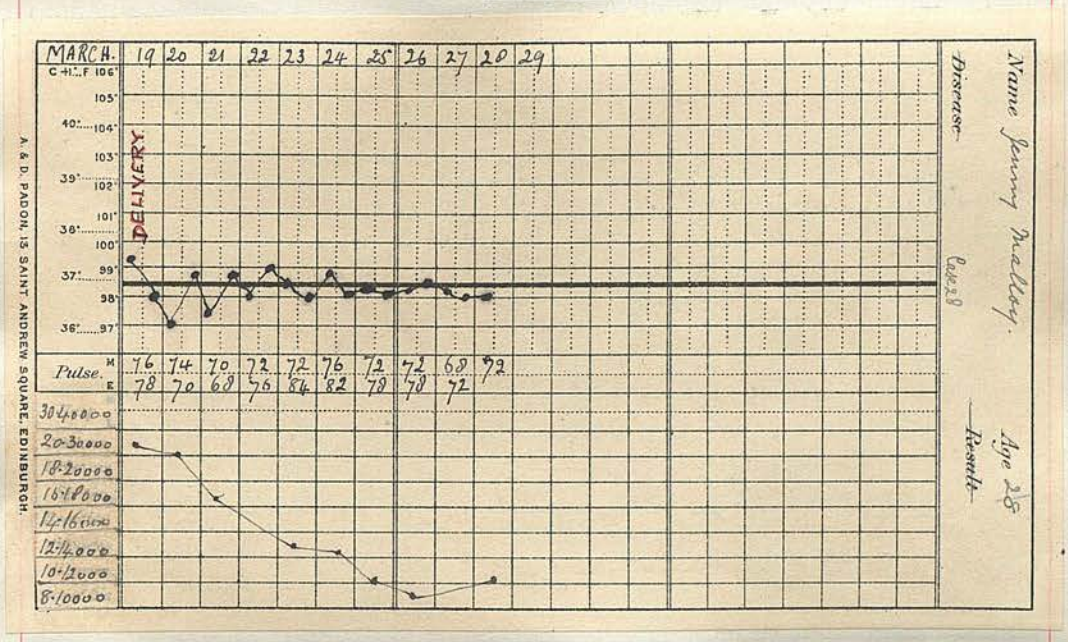


This patient was a primipara. Her labour and puerperium were perfectly normal.

The blood counts made were:----

March	14th.	16250.	Per	cubic	millimeter.
"	15th.	15000.	"	"	"
"	17th.	12500.	"	"	"
"	18th.	9375.	"	"	"
"	21st.	9687.	"	"	"
"	24th.	10000.	"	"	"

CASE XXVIII.

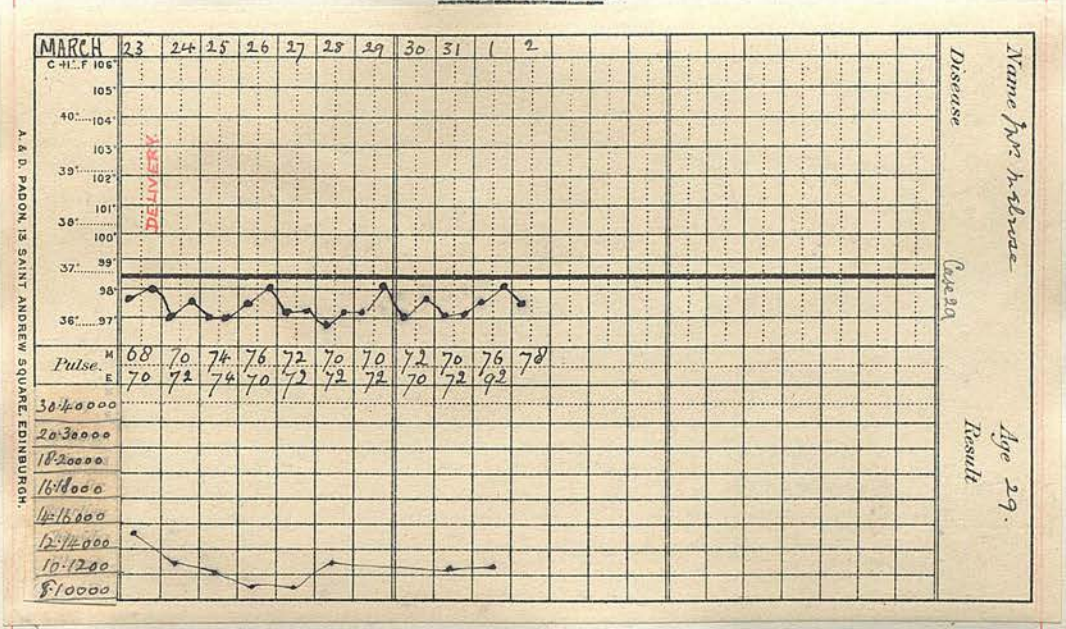


This patient was a II. para. She gave birth to a very small female child, while on her way to the Simpson Memorial Hospital. Her puerperium, however, was unaffected by this.

The counts made were:----

March	19th.	23750.	Per cubic	millimeter.
"	20th.	20312.	"	"
"	21st.	16250.	"	"
"	23rd.	13125.	"	"
"	24th.	12187.	"	"
"	25th.	10625.	"	"
"	26th.	9687.	"	"
"	28th.	10625.	"	"

CASE XXIX.

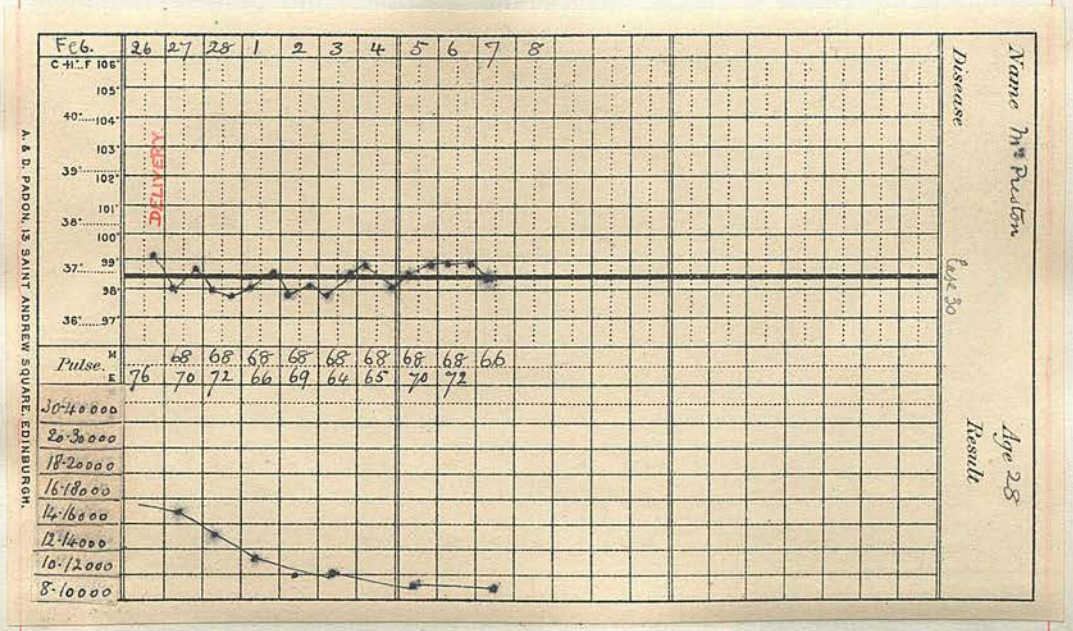


This patient was a IV. para. Both labour and puerperium were perfectly normal. The leucocyte count was never high but remained above 10,000 during the last 6 days she was in Hospital.

The actual blood counts were:----

March	23rd.	13437.	Per cubic	millimeter.
"	24th.	10625.	" "	"
"	25th.	10000.	" "	"
"	26th.	9162.	" "	"
"	27th.	9375.	" "	"
"	28th.	10937.	" "	"
"	30th.	10625.	" "	"
April	1st.	10937.	" "	"

CASE XXX.

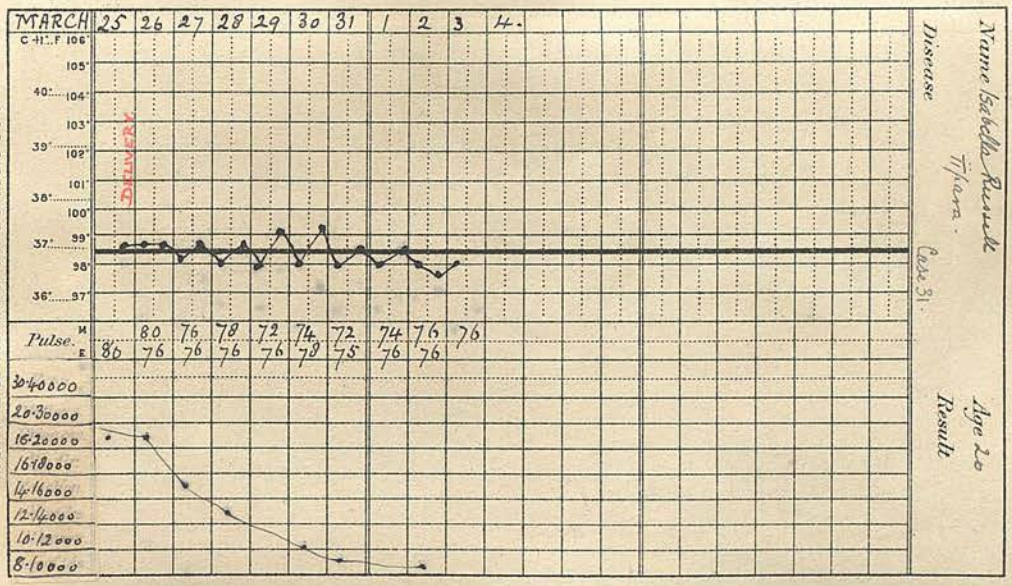


This patient was a V. para. Both labour and puerperium were perfectly normal.

The blood count was:----

Feb.	27th.	14375.	Per	cubic	millimeter.
"	28th.	13750.	"	"	"
March	1st.	12500.	"	"	"
"	3rd.	10625.	"	"	"
"	5th.	8750.	"	"	"
"	7th.	8125.	"	"	"

CASE XXXI.

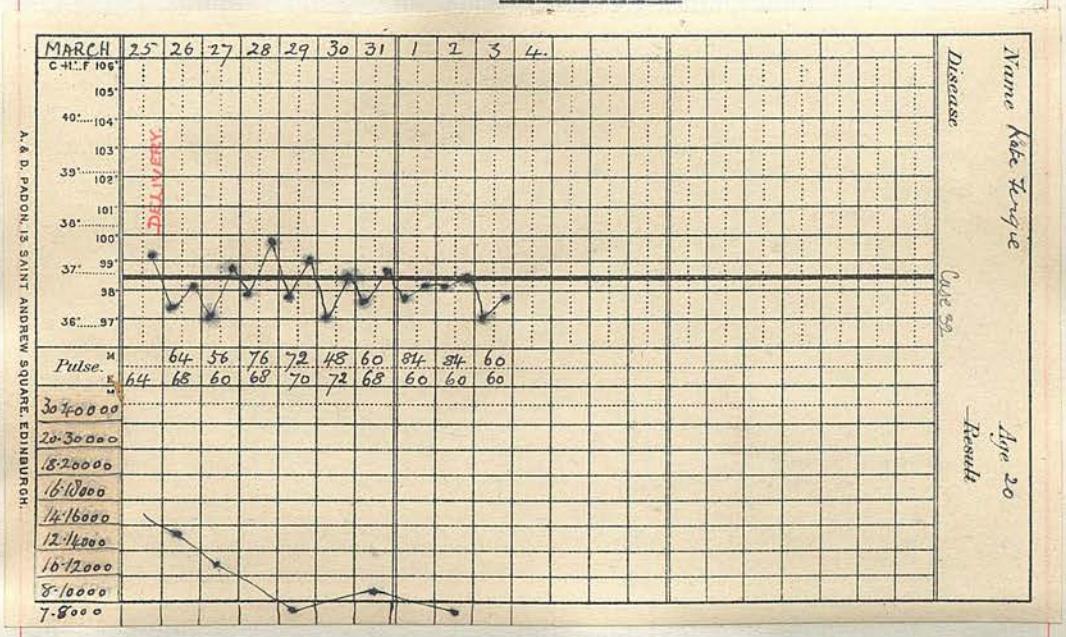


This patient was a II. para. Her labour was natural. During the puerperium the lochia on 28th, 29th and 30th, were very offensive and the temperature rose on these nights somewhat, without however, any accompanying rise in the leucocyte curve, or in the pulse rate.

The actual counts made were:----

March 26th.	19687.	Per	cubic	millimeter.
" 27th.	15625.	"	"	"
" 28th.	12187.	"	"	"
" 30th.	10000.	"	"	"
" 31st.	9375.	"	"	"
April 2nd.	9162.	"	"	"

CASE XXXII.

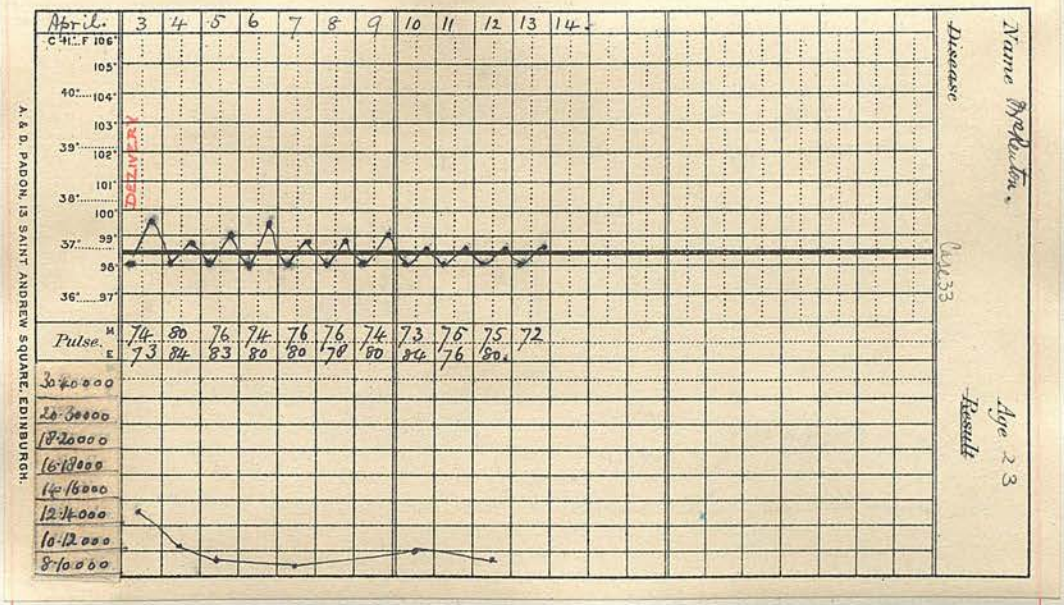


This patient was a II. para. Her labour was perfectly natural. On 28th, there was very slight foetor of lochia and the temperature was nearly 100, without, however, any disturbance in the pulse rate. The child died that night after a convulsion. It was a puny premature child, 7½ months. After this the breasts were slightly painful and had to be exhausted. This produced no effect upon the leucocyte count.

The actual counts made were:----

March	26th.	12500.	Per cubic millimeter.	
"	27th.	10937.	"	"
"	29th.	7812.	"	"
"	31st.	9162.	"	"
April	2nd.	7812.	"	"

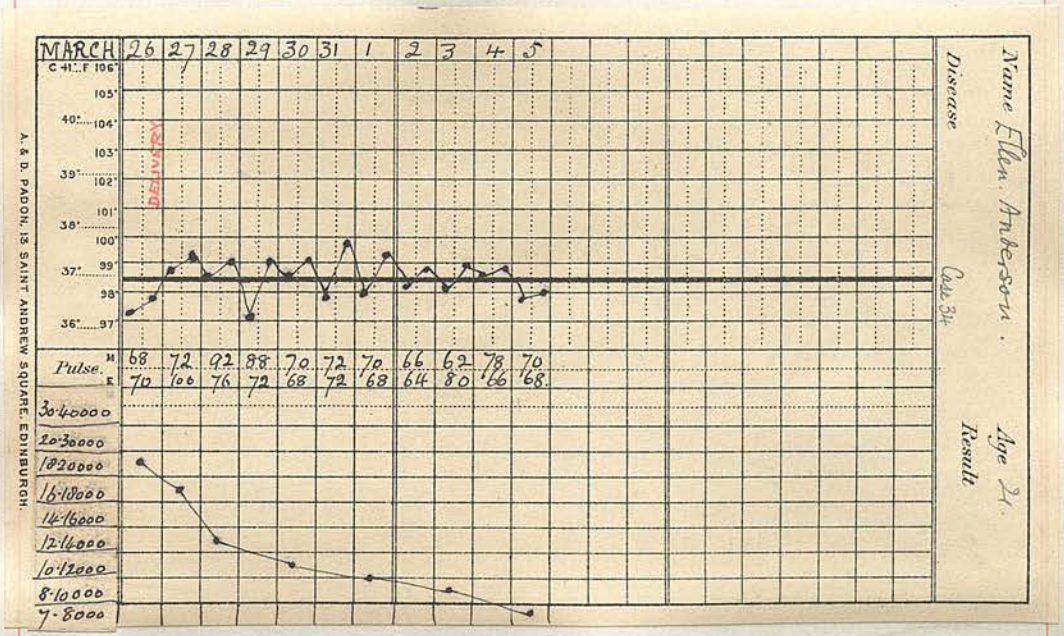
CASE XXXIII.



This patient was a III. para. Her labour was normal. But on the third day there was slight foetor of lochia, this only lasted three days. There was no disturbance of the pulse rate or the leucocyte count, which on the whole is a very low one.

April 3rd.	13750.	Per cubic millimeter.	
" 4th.	10625.	"	"
" 5th.	9375.	"	"
" 7th.	9162.	"	"
" 10th.	10000.	"	"
" 12th.	8750.	"	"

CASE XXXIV.

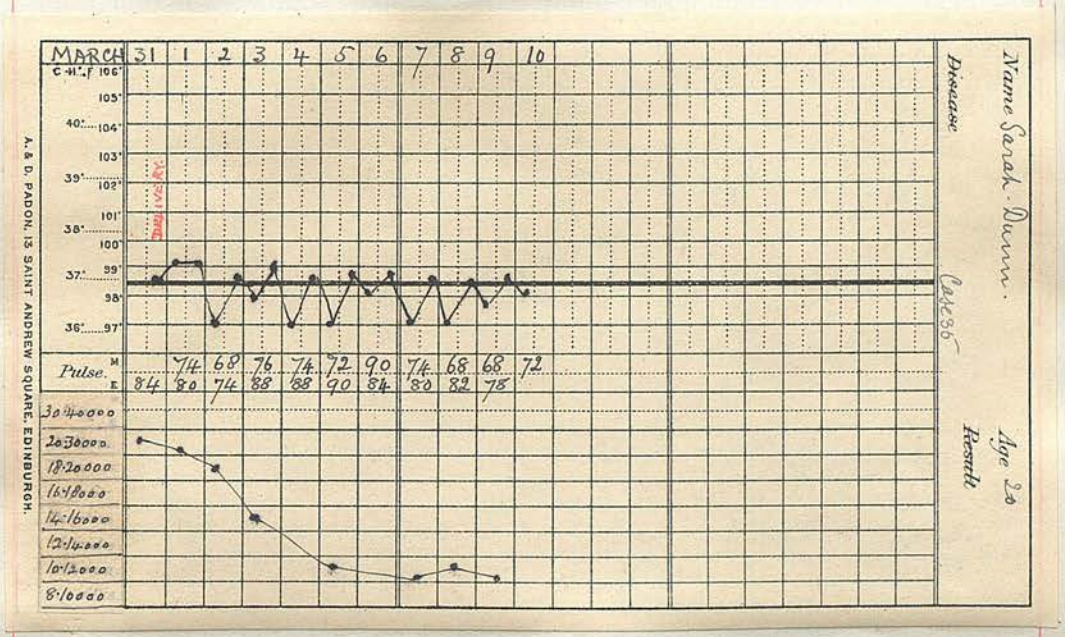


This patient was primipara. The second stage of labour was protracted owing to the position of the head which was Right Occipito Posterior; long rotation of the occiput to the front occurred but slowly. There was some irregularity of temperature during the puerperium accompanied by some foetor of lochia which, however, soon yielded to Vaginal Douching. The pulse is seen never to have been high except on the night of the 27th, and morning of 28th. The blood count is also seen to be progressively a falling one.

The actual counts made were:----

March	26th.	18437.	Per	cubic	millimeter.
"	27th.	16250.	"	"	"
"	28th.	13437.	"	"	"
"	30th.	11875.	"	"	"
April	1st.	10000.	"	"	"
"	3rd.	8750.	"	"	"
"	5th.	7812.	"	"	"

CASE XXXV.



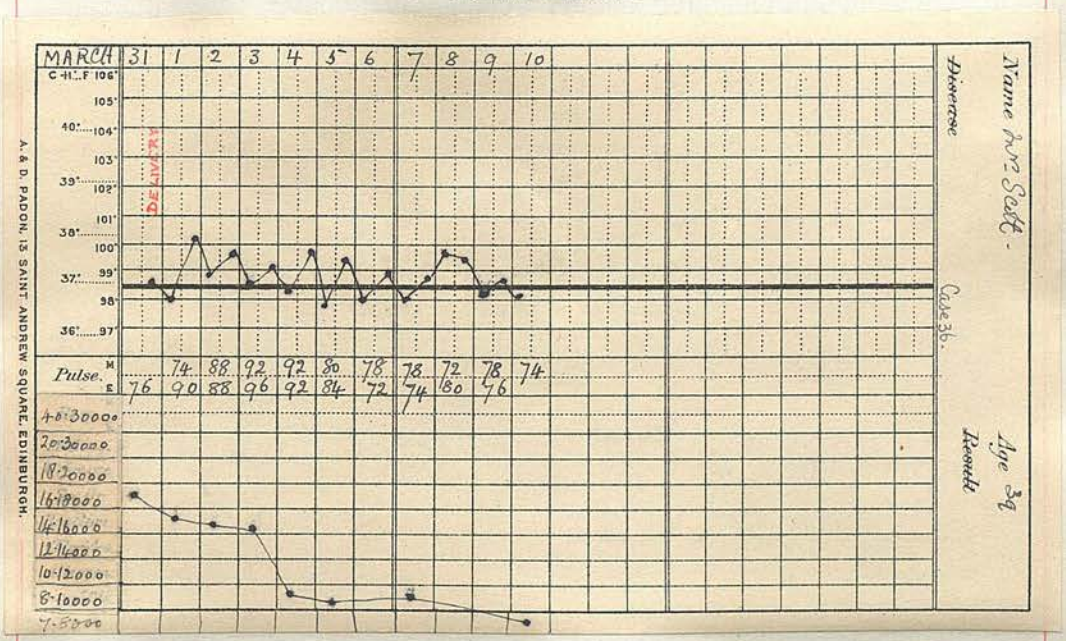
This case is one of a primipara. Her labour and puerperium were perfectly normal.

The leucocyte count at term was one of the highest I have records of, but had fallen as usual by the fourth day.

The actual counts were:----

March 31st.	23125.	Per cubic millimeter.	
April 1st.	22500.	"	"
" 2nd.	18750.	"	"
" 3rd.	14687.	"	"
" 5th.	11250.	"	"
" 7th.	10625.	"	"
" 8th.	11870.	"	"
" 9th.	10937.	"	"

CASE XXXVI.



This patient was a III para. She was delivered of 7 month twins. Both were born alive, one died a few minutes after birth and the second was placed in an incubator, but died on the third day. The third stage of labour was protracted, and it was found that the upper part of the placenta was adherent and had to be removed by the hand. On April 3rd the lochia were offensive and remained so for four days; there was, as is seen above, some irregularity of the temperature, unaccompanied, however, by any corresponding disturbance of the pulse rate. The leucocyte count is seen to remain fairly stationary for the first four days and then

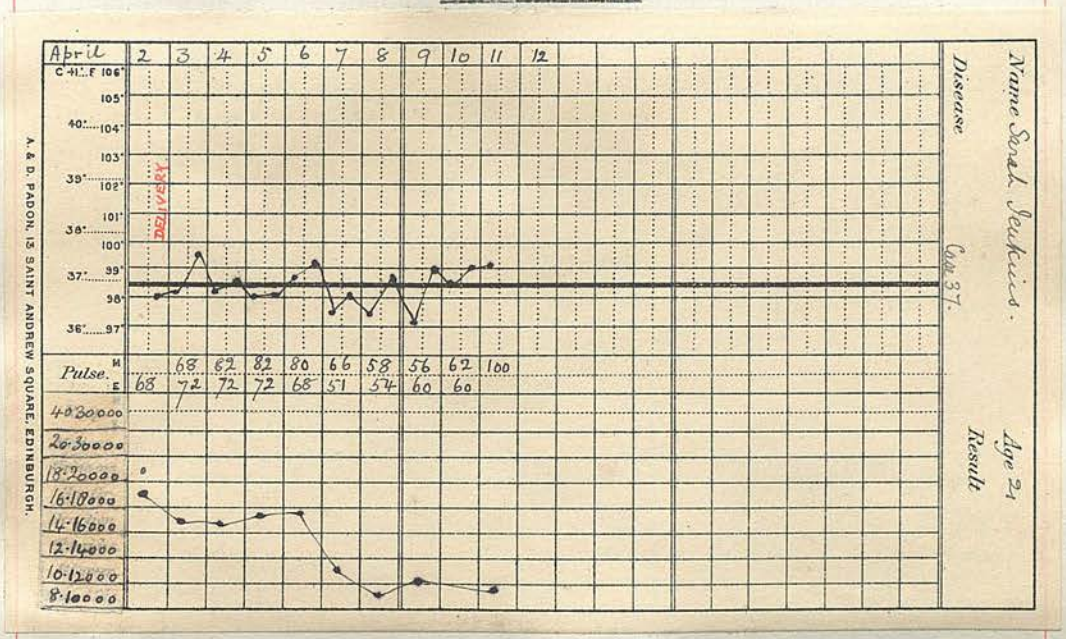
a/

drop to 9375 per cubic millimeter ensued, and the count remained low for the rest of the puerperium. It is interesting to note that the fall in leucocytes was marked on the fourth day, when the lochia were still offensive.

The actual counts made were:-----

March	31st.	16875.	Per	cubic	millimeter.
April	1st.	15937.	"	"	"
"	2nd.	15000.	"	"	"
"	3rd.	14375.	"	"	"
"	4th.	9375.	"	"	"
"	5th.	8437.	"	"	"
"	7th.	9162.	"	"	"
"	10th.	7812.	"	"	"

CASE XXXVII.

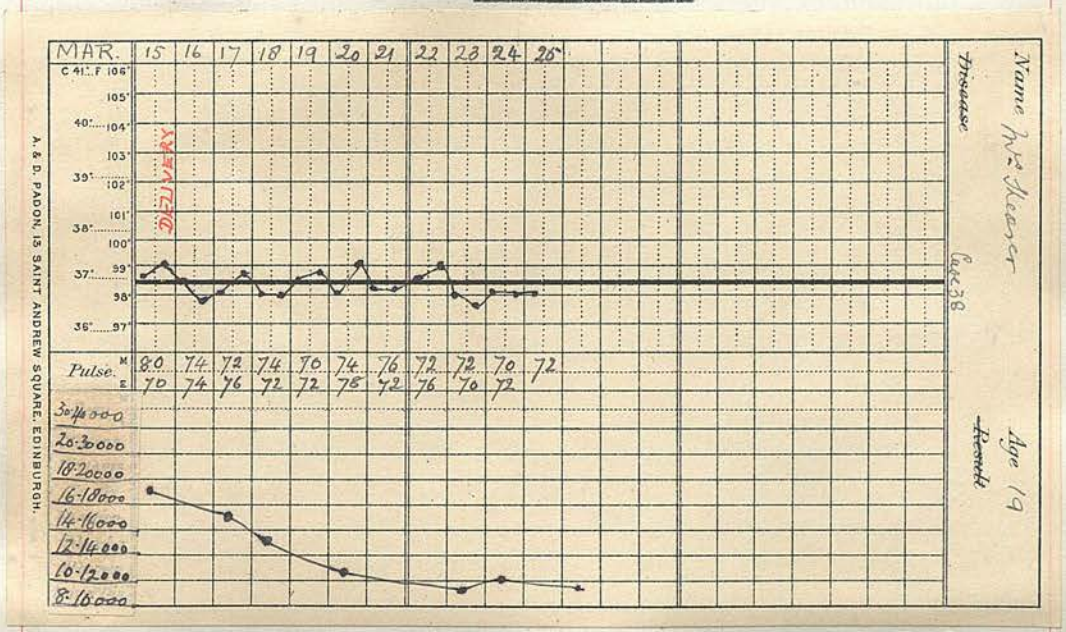


This patient was a primipara. Her labour was a normal one. During the puerperium she developed an extremely offensive lochial discharge. The involution of the Uterus was somewhat tardy at first, but by the tenth day, the fundus was at the level of the brim. The temperature is a little irregular and the leucocytes did not fall in number till the 6th day. There was no disturbance of the pulse rate.

The actual counts made were:-----

April	2nd.	17187.	Per cubic	millimeter.
"	3rd.	15937.	" "	"
"	4th.	14375.	" "	"
"	5th.	15625.	" "	"
"	7th.	11875.	" "	"
"	8th.	8437.	" "	"
"	9th.	10625.	" "	"
"	10th.	9687.	" "	"

CASE XXXVIII.

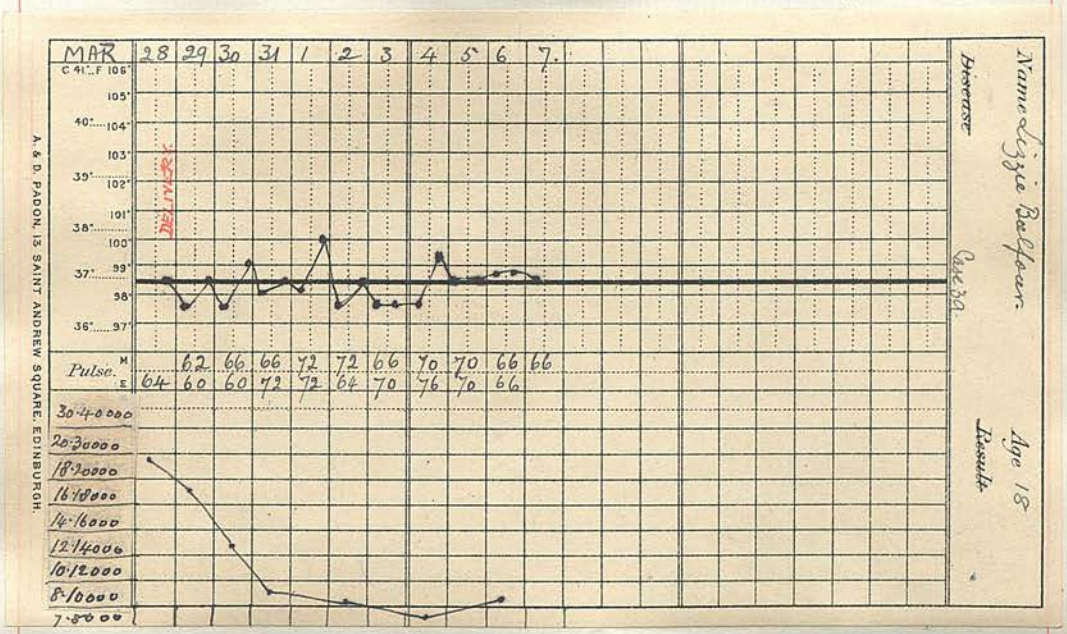


This patient was II. para. Her labour and puerperium were perfectly normal.

The actual blood counts made were:----

March	15th.	17500.	Per cubic	millimeter.
"	17th.	15625.	" "	"
"	18th.	14687.	" "	"
"	20th.	10937.	" "	"
"	23rd.	9375.	" "	"
"	24th.	10000.	" "	"
"	25th.	9162.	" "	"

CASE XXXIX.

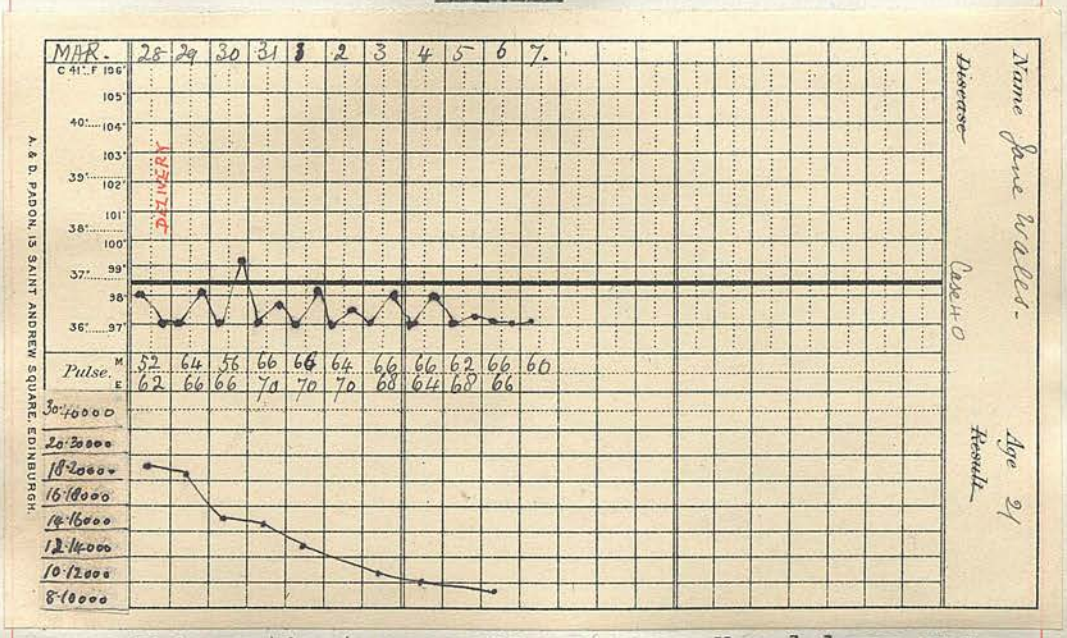


This patient was a primipara, Her labour was quite normal. During the puerperium she had a good deal of foetor of lochia, which accounts for the irregular temperature. Neither the pulse nor leucocyte count were affected by this. As usual the parallel between the pulse rate and leucocyte curve is marked, the counts being low on the 1st, when the temperature was at its highest.

The actual counts made were:----

March	28th.	19375.	Per cubic millimeter.	
"	29th.	16562.	"	"
"	30th.	12812.	"	"
"	31st.	9375.	"	"
April	2nd.	8125.	"	"
"	4th.	7812.	"	"
"	6th.	8437.	"	"

CASE XL.

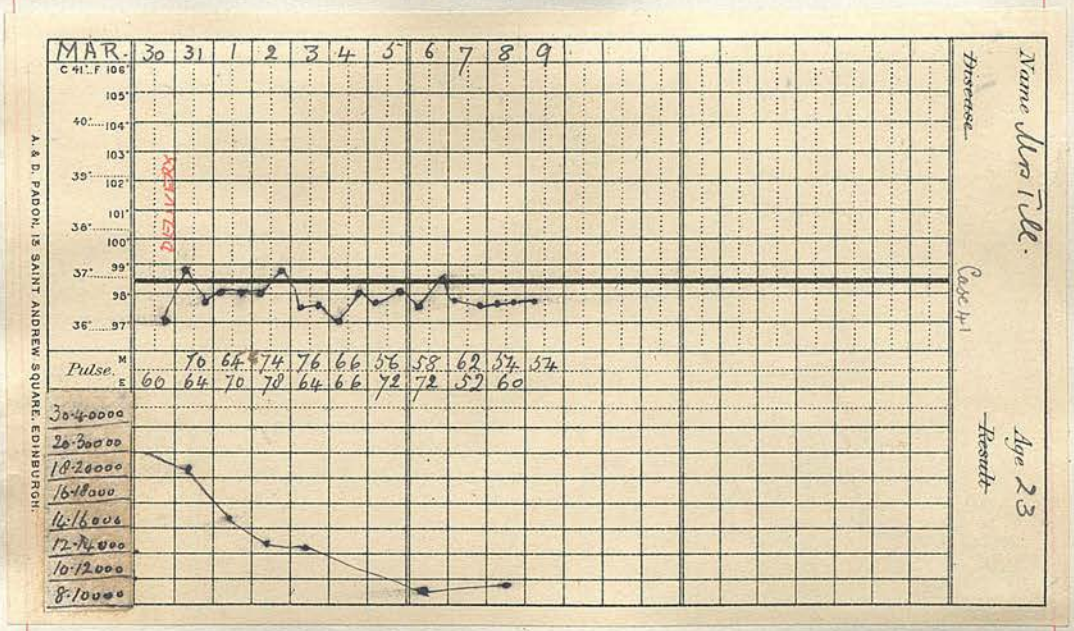


This patient was a II, para. Her labour was normal. During the puerperium she had very slight foetor of lochia, which quickly subsided.

The leucocyte counts were:----

March 28th.	19062.	Per cubic Millimeter.		
" 29th.	18125.	"	"	"
" 30th.	15937.	"	"	"
" 31st.	15625.	"	"	"
April 1st.	13125.	"	"	"
" 3rd.	11875.	"	"	"
" 4th.	10000.	"	"	"
" 6th.	9375.	"	"	"

CASE XLI.

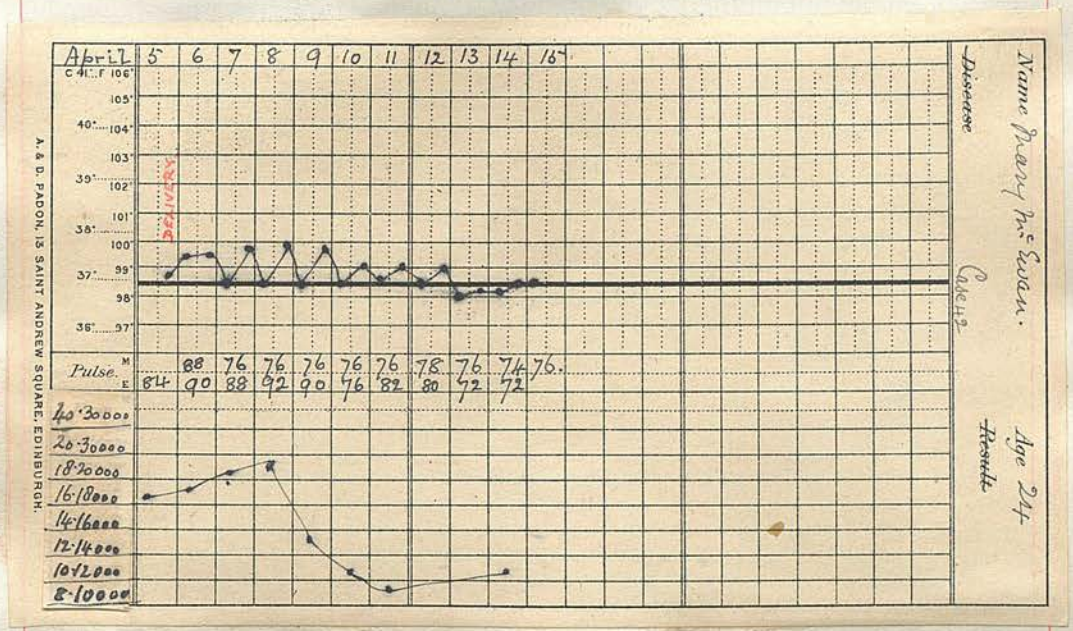


This patient was a II. para. Her labour was very precipitate, the child being expelled before the os was dilated. This caused a considerable laceration of the cervix followed by a smart haemorrhage. The perineum was badly torn. The puerperium was uncomplicated.

The counts made were:----

March 31st.	18750.	Per cubic millimeter.		
April 1st.	14062.	"	"	"
" 2nd.	13437.	"	"	"
" 3rd.	12500.	"	"	"
" 6th.	8437.	"	"	"
" 8th.	9162.	"	"	"

CASE XLII.



This patient was a primipara. Her labour was rather precipitate, and she incurred a bad tear of the perineum. On April 7th, she had a good deal of pain in the abdomen, rather to the left of the middle line. This subsided in two days. The temperature is seen to be irregular for the first week, the pulse not much disturbed, but the leucocyte count an ascending one for 3 days. This being the time when there seemed to be a little pelvis cellulitis. Again, here the fall in leucocytes indicated the improvement before the temperature.

The counts made were:----

April 5th. 16562. Per cubic millimeter.
(Before delivery).

" 6th. 17812. " " millimeter.
(After delivery).

" 7th. 18750. " " millimeter.

" 8th. 19687. " " "

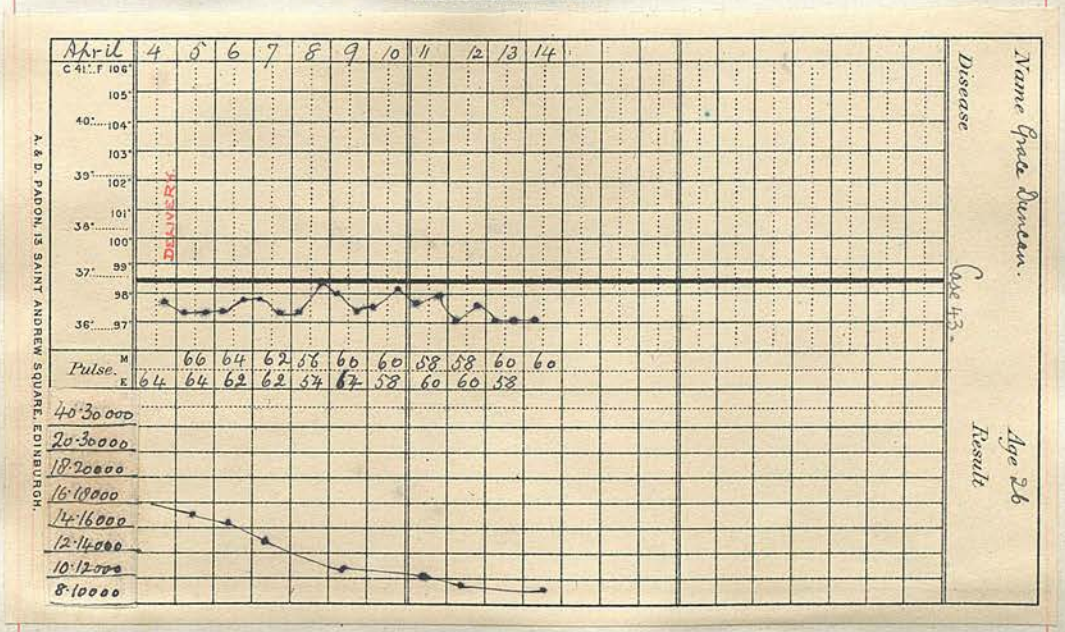
" 9th. 12500. " " "

" 10th. 10625. " " "

" 11th. 9625. " " "

" 14th. 10625. " " "

CASE XLIII.

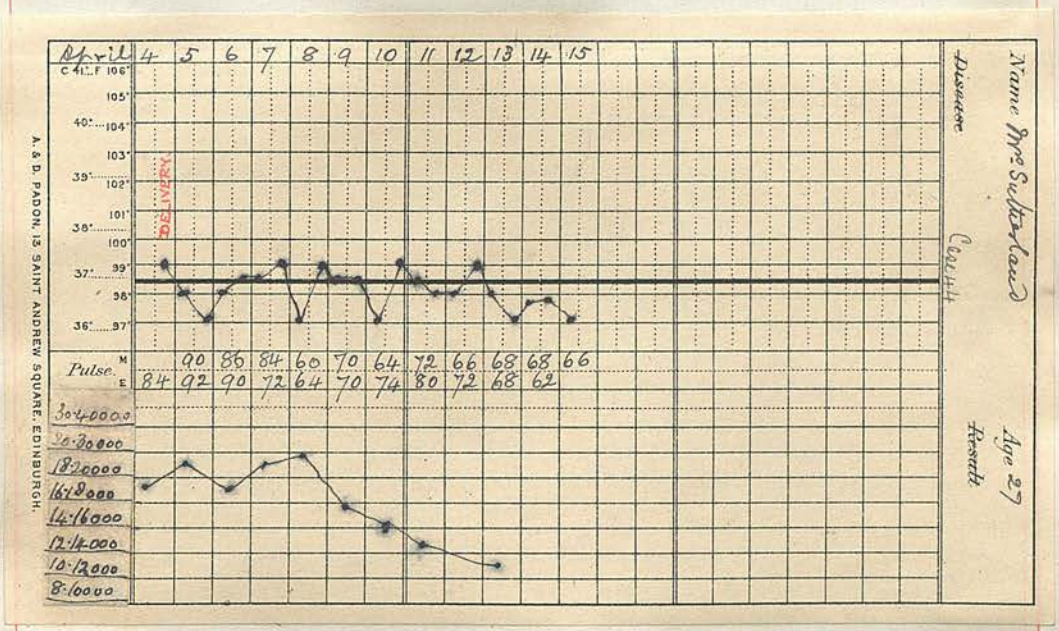


This patient was a primipara. Her labour and puerperium were quite normal.

The counts were:----

April 5th. 15312. Per cubic millimeter.
" 6th. 14687. " " "
" 7th. 13750. " " "
" 9th. 11250. " " "
" 11th. 10000. " " "
" 12th. 9162. " " "
" 14th. 8125. " " "

CASE XLIV.

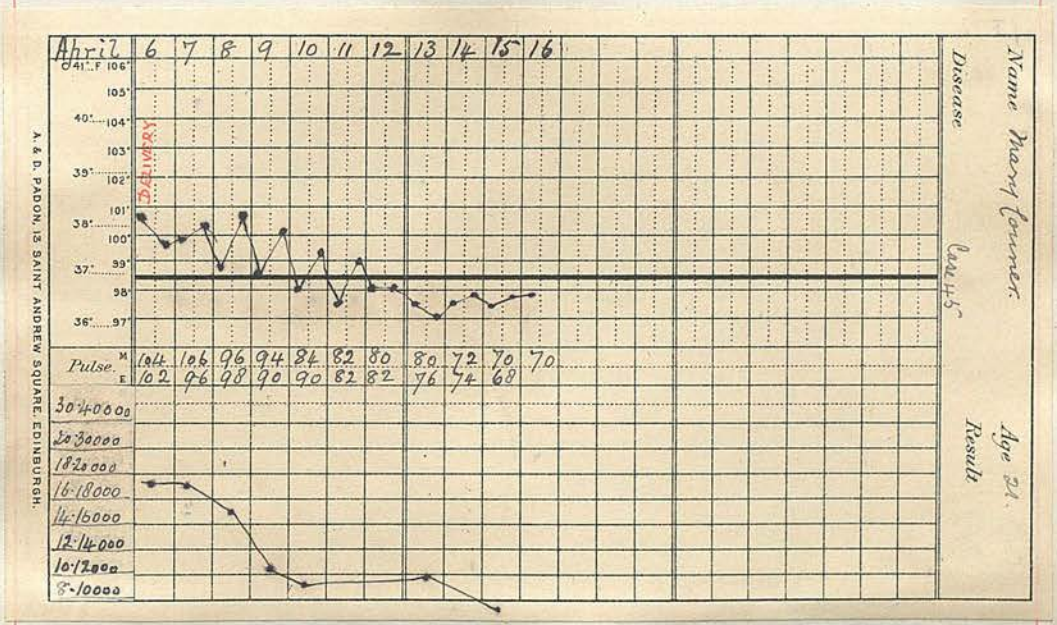


This patient was a primipara with a rickety flat pelvis and a conjugata vera of $2\frac{3}{4}$ inches. The child presented by the breech, and great difficulty was experienced in effecting delivery, owing to the small pelvis and relative large size of the child. Delivery was finally accomplished by perforation of the after-coming head and strong supra putre pressure. The patient was much exhausted as the result of the long labour, which lasted twenty four hours, the last two of which she was under chloroform. She made an excellent recovery in spite of a slight temporary jaundice on the 3rd, 4th and 5th days of the puerperium which it is interesting/

interesting to note was accompanied by a distinct leucocytosis.

April	4th.	17500.	Per	cubic	millimeter.
"	5th.	18125.	"	"	"
"	6th.	17500.	"	"	"
"	7th.	18125.	"	"	"
"	8th.	19375.	"	"	"
"	9th.	16562.	"	"	"
"	10th.	14375.	"	"	"
"	11th.	12500.	"	"	"
"	13th.	11562.	"	"	"

CASE XLV.

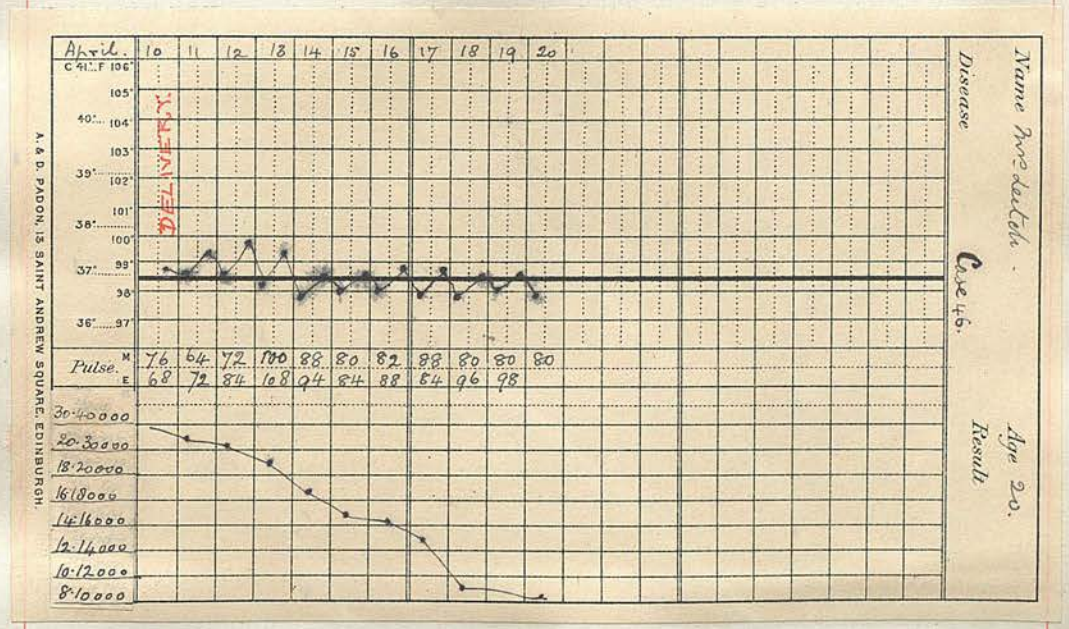


This patient was a primipara. The labour was a normal one, but there was great foetor at the time of birth and this lasted throughout the puerperium, becoming rather less by the 14th April. Vaginal douches were carried on four times in the twenty four hours, so great was the foetor. The lochia were also excessive. The involution of the Uterus, however, was perfectly normal.

The counts were:----

April	7th.	17500.	Per cubic millimeter.	
"	8th.	14375.	"	"
"	9th.	10937.	"	"
"	10th.	8750.	"	"
"	13th.	9375.	"	"
"	15th.	7812.	"	"

CASE XLVI.



This was a patient II. para. During her first pregnancy she developed slight oedema of hands, face and legs. Her Urine was scanty and contained Albumin. She never had any convulsions. Her child was born dead prematurely. During the present pregnancy she again developed the same symptoms. She did not have any convulsions, but suffered from severe headaches, and her Urine contained a cloud of Albumin. She went into labour at the 7th month, and was again delivered of a dead child. There was some oscillation of the temperature during the first three days of the puerperium, and on the 3rd day the pulse was above 100. She was given an enema and the rest of the puerperium/

puerperium was perfectly normal. The leucocyte count is seen to be very high to start with, and is maintained higher than usual during the first week of the puerperium.

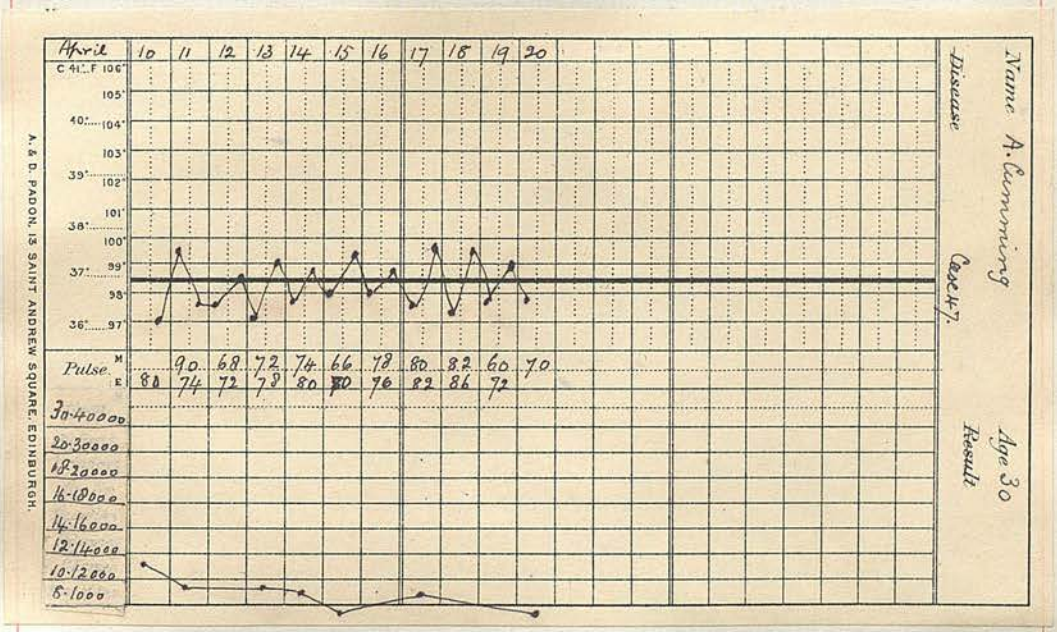
This case compares well with case XIV. which was an ordinary case of Eclampsia with convulsions.

Here the leucocyte count was on the whole much lower, but was maintained higher than normal during the whole of the first week of the puerperium as in this case. The involution of the uterus was perfectly normal, as also were the lochia.

The leucocyte count was:----

April	11th.	21875.	Per	cubic	millimeter.
"	12th.	20000.	"	"	"
"	13th.	18125.	"	"	"
"	14th.	17187.	"	"	"
"	15th.	14687.	"	"	"
"	16th.	14062.	"	"	"
"	17th.	13437.	"	"	"
"	18th.	9375.	"	"	"
"	20th.	9162.	"	"	"

CASE XLVII.

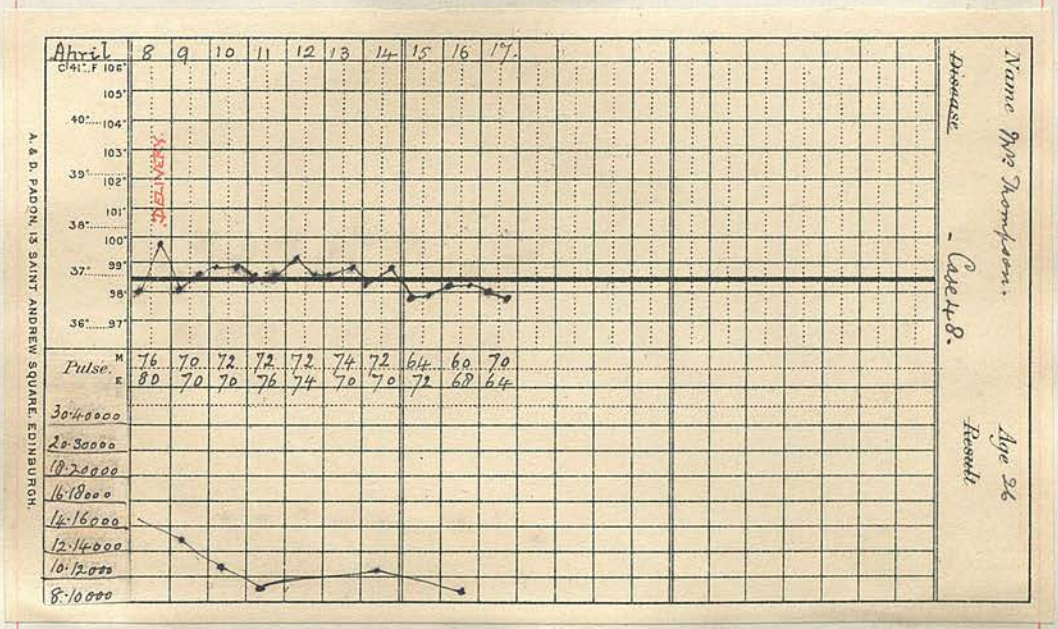


This patient was a II. para. She was distinctly anaemic, her red cells only numbering 3750,000. Her lochia during the puerperium were offensive requiring Vaginal Douching daily. The temperature is seen to be irregular but the pulse rate never gave anxiety. The leucocyte count is a low one for a puerperal case, but I think this is explained by the anaemic condition of her blood. The case compares well with case IV.

The actual counts made were:---

April	10th	11250.	Per	cubic	millimeter.
"	11th	9375.	"	"	"
"	13th	9375.	"	"	"
"	14th	8750.	"	"	"
"	15th	7812.	"	"	"
"	17th	8125.	"	"	"
"	20th	7800.	"	"	"

CASE XLVIII.

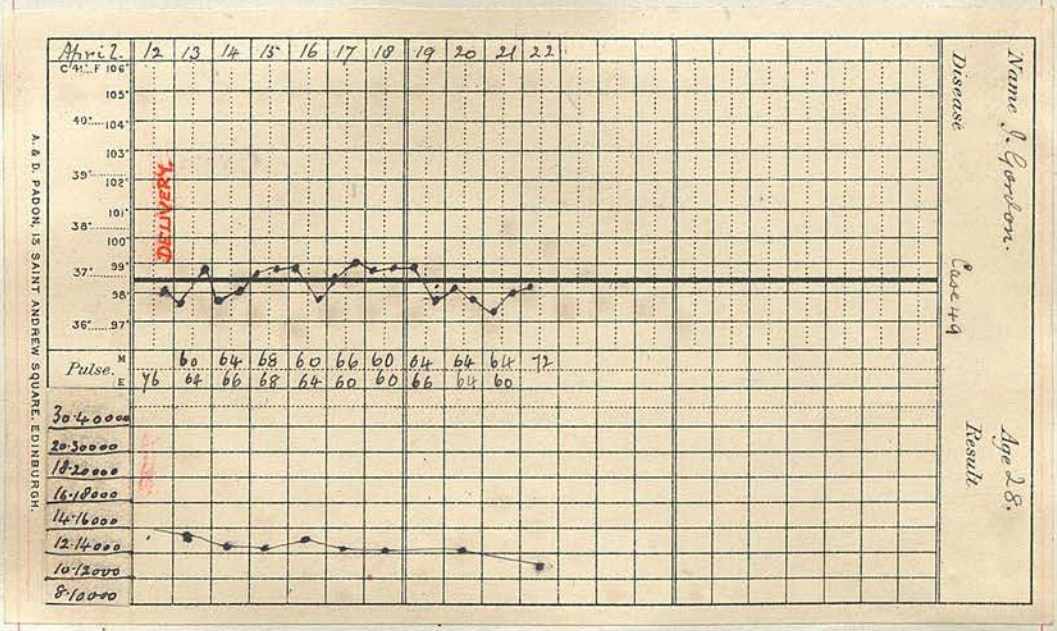


This patient was a II. para. Both her labour and puerperium were perfectly normal.

The leucocyte counts were:----

April 9th.	12812.	Per	cubic	millimeter.
" 10th.	10937.	"	"	"
" 11th.	8750.	"	"	"
" 14th.	10625.	"	"	"
" 15th.	9162.	"	"	"

CASE XLVIX.

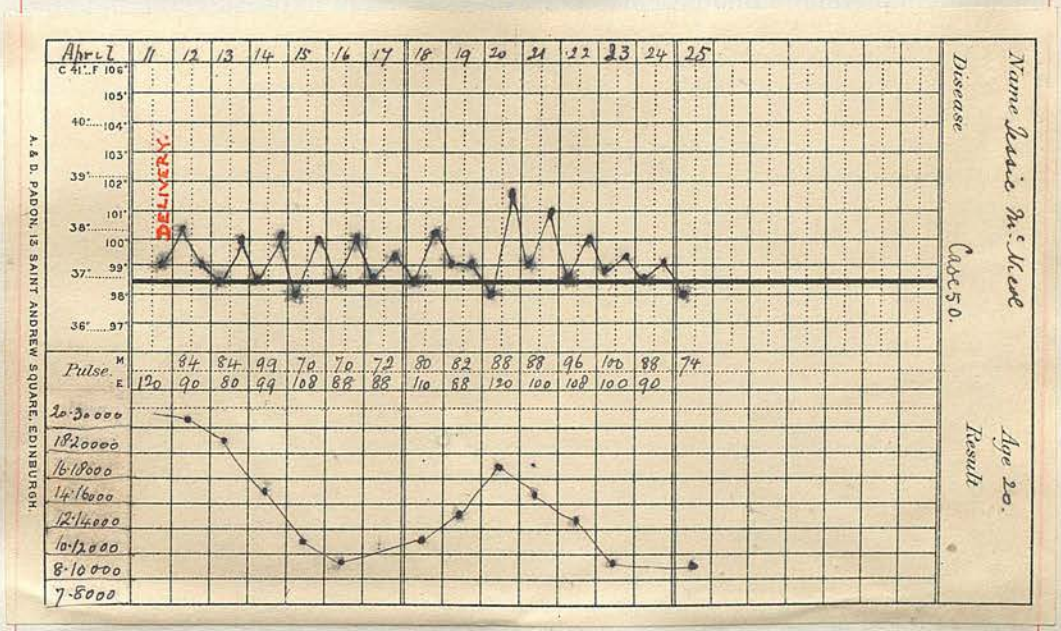


This patient was a iv-para. Her labour was normal and she had no complications in the puerperium. It is seen that her leucocyte count was never high, consequently we find very little variation in it.

The actual counts made, were:-

April 13th 14375 per cubic millimetre.
" 14th 13750 " " "
" 15th 12500 " " "
" 16th 13437 " " "
" 17th 12500 " " "
" 18th 11250 " " "
" 20th 10937 " " "
" 22nd 9375 " " "

CASE L.



This patient was a perfectly healthy primipara. Her labour required the assistance of forceps, and her perineum received a tear, requiring four stitches.

During the puerperium, it is seen from the chart above that her temperature was extremely irregular, touching practically 100 on each night of the first week, and that subsequently on the 20th, it rose to 101.5, and then gradually fell to normal. She never had any lochial foetor, the involution of the uterus appeared practically normal, her abdomen was free from tenderness or pain, and the torn perineum healed beautifully. Her lungs and heart were examined, but nothing could be found there to account for/

for her temperature. On the 18th, she had a little pain in the left side close to the Kidney region, but this passed off in two days. Her urine was normal as regards quantity and quality. During the 22nd, she had a severe headache, and her tongue, which had been furred, was cleaner. I may here say that her bowels were never constipated. By the 23rd she was practically well. By looking at the leucocyte curve, we see that the rise on the 7th day, which has been observed in other cases, was followed by a still higher rise on the following days, instead of by the customary fall, and that this change in the leucocyte count began to manifest itself before the temperature chart, or the condition of the patient, suggested that any complication was about to appear. This is the only case of the kind that I have been able to examine.

Probably, the case was one of very mild septic infection, through the torn perineum possibly. The patient made an entirely good recovery.

The actual counts made, are striking:-

April	12th	20312	per	cubic	millimetre.
"	13th	19375	"	"	"
"	14th	15625	"	"	"
"	15th	10937	"	"	"
"	16th	8750	"	"	"
"	18th	10625	"	"	"
"	19th	12500	"	"	"
"	20th	17812	"	"	"
"	21st	14375	"	"	"
"	22nd	13437	"	"	"
"	23rd	9687	"	"	"
"	28th	9162	"	"	"

We may now proceed to a brief analysis of the foregoing cases.

We find that of the 50 cases recorded, 25 were primiparae and 25 were multiparae. Of these, 43 were practically perfectly normal cases, for though a degree of foetor of the lochia was noticed in some of these cases for a day or so, it does not seem necessary to take them up separately, since a comparison of their temperatures, pulse rates and leucocyte counts fails to show any essential difference.

Of the 7 remaining, two were typical eclampsias, and one showed all the signs and symptoms premonitory to eclamptic convulsions (e.g., headaches, persistent, though mild vomiting, oedema of the body, scanty, albuminous urine, etc.) without an actual seizure, the natural expulsion of a dead child at the 7th month, bringing the case to a favourable termination.

In the remaining 4 cases, one was complicated with an attack of pleurisy, another showed some symptoms of a slight cellulitis, another was one with gonorrhoeal vaginitis, while the last was somewhat obscure, and is discussed fully along with the record of the cases. With regard to these last four cases, I do not propose to refer further, as deductions/

deductions, drawn from such a limited number must of necessity, be worthless; still, the fact remains that out of the 50 cases, only those which showed some definite abnormality to ordinary clinical examination revealed a definite rise over what we may be considered to have established as the normal leucocyte count of the puerperium. I now propose to submit charts illustrating the leucocyte curves in the more important groups. Tables are also annexed showing the counts of the Red Blood Corpuscles in several cases. And I have prepared a table showing the differential counts of the leucocytes in primiparae and multiparae respectively.

Table I.
represents the leucocyte count on the day of delivery in 12 primiparae.

Case 1.	35625	per cubic millimeter
Case 3.	28437	,, ,, ,,
Case 8.	14062	,, ,, ,,
Case 9.	130750	,, ,, ,,
Case 18.	19062	,, ,, ,,
Case 23.	10937	,, ,, ,,
Case 26.	14062	,, ,, ,,
Case 27.	16250	,, ,, ,,
Case 34.	18437	,, ,, ,,
Case 35.	23125	,, ,, ,,
Case 37.	17187	,, ,, ,,
Case 39.	19375	,, ,, ,,
Average on 12 Cases	19192	,, ,, ,,

Table II.
represents the leucocyte count on the day of delivery in 16 multiparae.

Case 4.	10000	per cubic millimeter
Case 5.	16250	,, ,, ,,
Case 6.	15625	,, ,, ,,
Case 7.	9375	,, ,, ,,
Case 10.	14375	,, ,, ,,
Case 11.	16250	,, ,, ,,
Case 12.	15000	,, ,, ,,
Case 21.	10625	,, ,, ,,
Case 22.	10937	,, ,, ,,
Case 28.	23750	,, ,, ,,
Case 29.	13437	,, ,, ,,
Case 33.	13750	,, ,, ,,
Case 36.	16875	,, ,, ,,
Case 38.	17500	,, ,, ,,
Case 40.	19062	,, ,, ,,
Case 47.	11250	,, ,, ,,
Average on 16 Cases	14628	,, ,, ,,

These may be taken to represent the average leucocyte count at the end of pregnancy.

The average leucocyte counts in the puerperium obtained from 20 of the foregoing normal primiparae, is, therefore, as follows:-

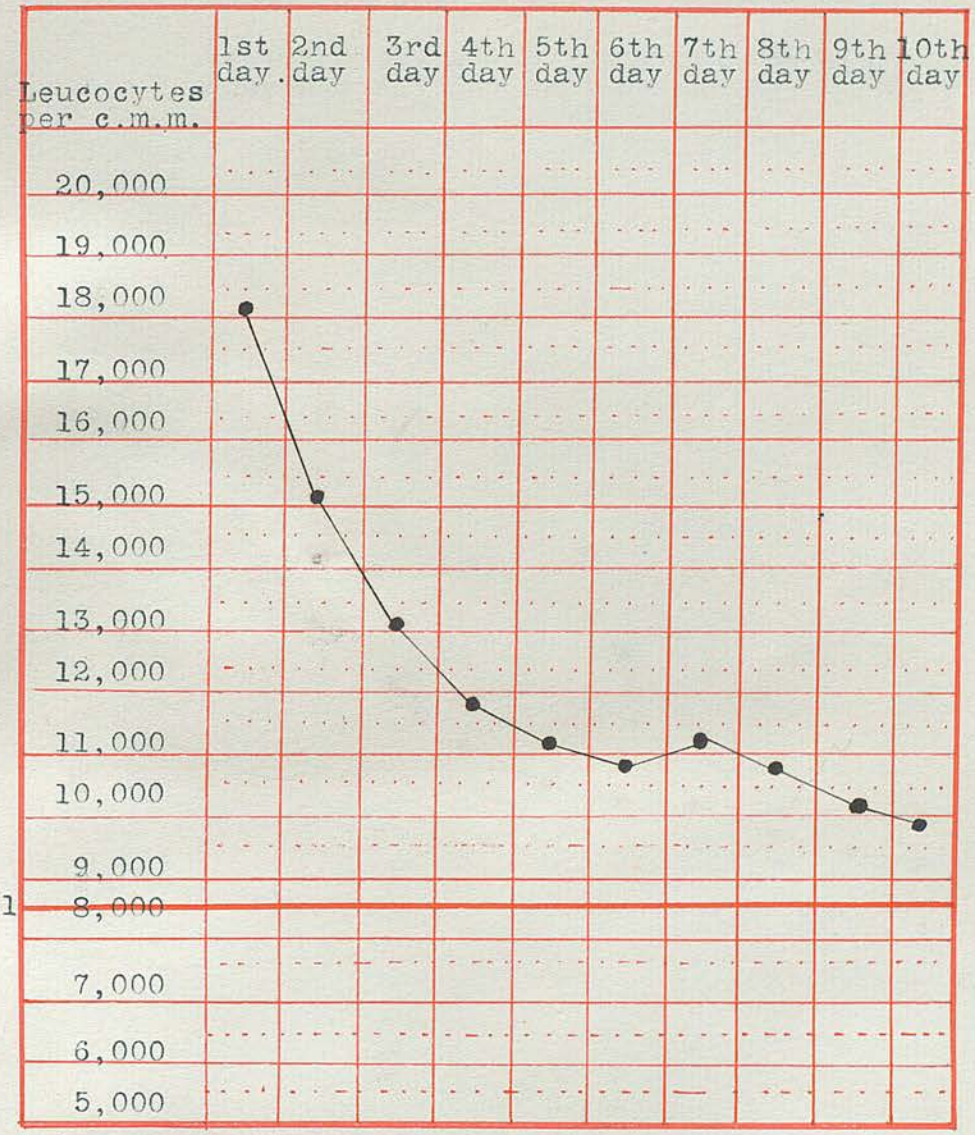
1st	day of	Puerperium	17121	per cub.	millimetre
2nd	"	"	14240	" "	"
3rd	"	"	12369	" "	"
4th	"	"	10942	" "	"
5th	"	"	10132	" "	"
6th	"	"	9931	" "	"
7th	"	"	10084	" "	"
8th	"	"	9657	" "	"
9th	"	"	9088	" "	"
10th	"	"	8845	" "	"

A similar average leucocyte count in 23 multiparae is as follows:-

1st	day of	Puerperium	13692	per cub.	millimetre.
2nd	"	"	12228	" "	"
3rd	"	"	11077	" "	"
4th	"	"	10082	" "	"
5th	"	"	9683	" "	"
6th	"	"	9304	" "	"
7th	"	"	9045	" "	"
8th	"	"	8925	" "	"
9th	"	"	8763	" "	"
10th	"	"	8431	" "	"

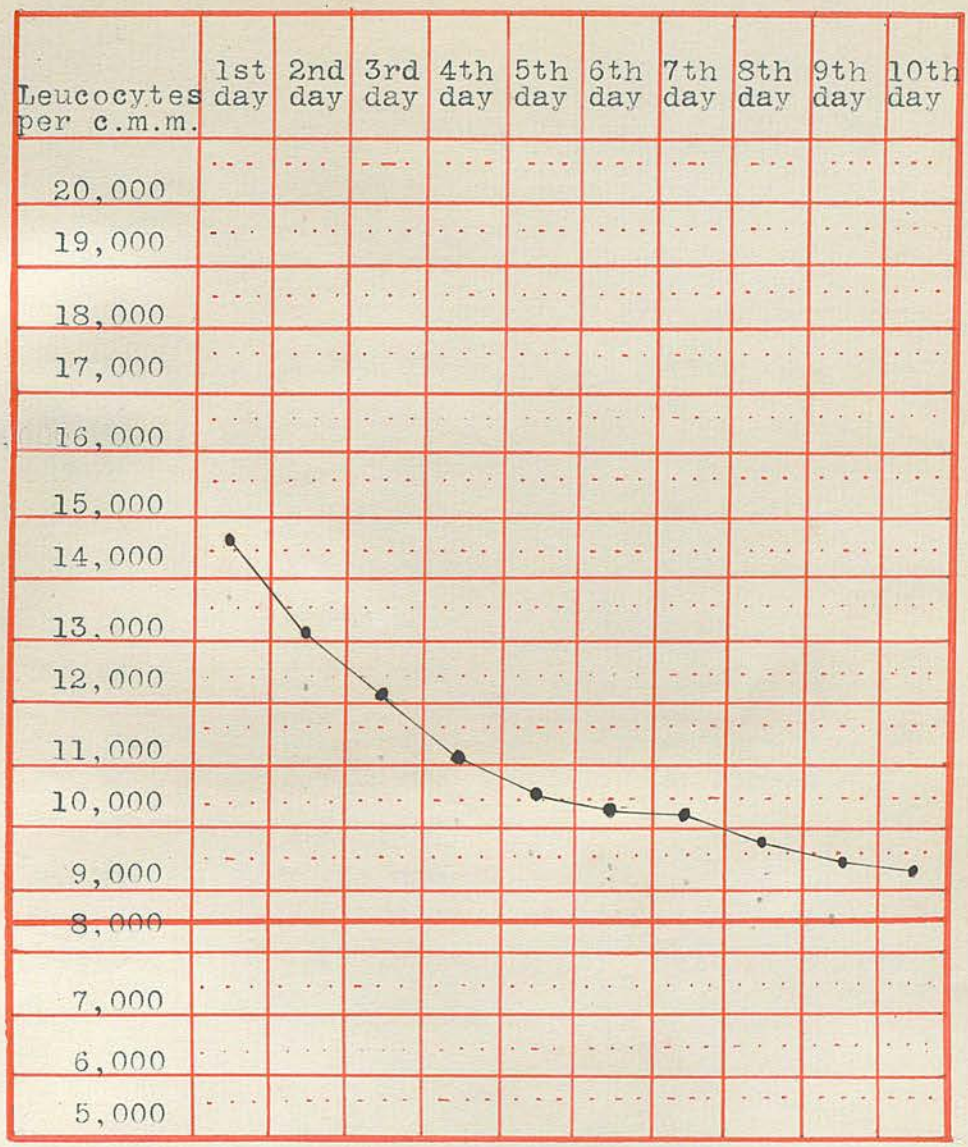
These results are shown in graphic forms in Charts III. and IV. which follow.

Chart III.



This Chart represents the average leucocyte count in 20 primiparae whose puerperium ran a normal course.

Chart IV.



This Chart represents the leucocyte curve in 23 multiparae in whom the puerperium was normal.

Table VII.

Case	No. of Red cells per cubic millmeter.	
No.19	3,850,000	Primipara
No.23	3,600,000	,, ,,
No.37	3,860,000	,, ,,
No.39	4,200,000	,, ,,
No.42	4,600,000	,, ,,
No.43	4,700,000	,, ,,
No.44	4,700,000	,, ,,
No.40	3,900,500	Multipara
No.41	4,150,000	,, ,,
No.47	3,750,000	,, ,,
Average	4,131,050	Multip. & Primip.

This table represents the count of red cells per cubic millimeter at term.

Before passing to the more detailed considerations of our foregoing observations and to the conclusions to be drawn from them, it will be interesting to make reference to the work done by others in this subject.

The alterations met with in the blood of pregnancy and the puerperium are quantitative as well as qualitative.

Firstly, the quantity of the blood itself is very much increased, there being a greater demand by the enlarged uterus and circulatory area caused by the presence of the foetus, whose nutrition has to be maintained to a greater and greater extent as the pregnancy advances.

Secondly, with regard to the qualitative changes, Andral, Gavarret, Rodier, Regnauld, Delafond and Nasse have long ago shown that there is an increase in the white corpuscles of the blood, also of the fibrin and watery elements, together with a diminution of the Albumin and Red Blood Corpuscles, though Ingerslev denied that there was any fall in the number of red cells during pregnancy, indeed, Fehling considered there was an increase in the red cells.

More recently, Meyer made a series of investigations/

tions and came to the conclusion that the Red Cells and amount of Haemoglobin were diminished in pregnancy and that after labour, they both rapidly increased again.

Quinquad points out a progressive fall in the Haemoglobin, and Caseaux, after a series of observations on the blood of the pregnant woman, describes it as analogous to that of Chlorosis.

The work recorded as to the actual counts made on cases, is extremely scanty. This may be explained by the fact that it is only comparatively lately that the methods for such examinations have been accurate and trustworthy. The question of leucocytosis is of still later development; much more attention has been paid to the quantitative changes in the Red Cells than in the Leucocytes.

Kosina and Eckert examined 16 cases of labour and found a leucocytosis of between 10540 and 10600 per cmm. Kruger considers 1300 to be the average. Taking 7700 as the normal leucocyte count, Rieder states that just before and after labour, the increase is 2 to 3 times the normal, and that this falls rapidly from that time to the end of the puerperium.

Elder and Hutchinson examined the blood of 11 puerperal cases and found an average leucocyte count of 14,522 per cmm; and an average of 3,978,937 Red Cells/

Cells per cubic millimetre in 16 cases; the average amount of Haemoglobin they state as being 72%.

Henderson examined 38 cases at term and found the average number of leucocytes to be 21,365 per cubic millimetre and that this gradually and steadily fell during the subsequent days of the puerperium to 12,327 per cubic millimetre on the tenth day.

The Haemoglobin was examined in 37 cases and found to average 68.2% at term, and that this gradually increased somewhat irregularly to the tenth day, when the average of 8 cases was 74-75%. With regard to the Red cells, he found 3,975,348 per cmm. to be the average at term and that during the first two days of the puerperium, there was a slight diminution in the number, probably caused by the inevitable haemorrhage at the time of delivery. After this, the cells rise in number to 4,200,500 per cubic millimetre, falling again by the 10th day somewhat.

Cabot states that 13,000 leucocytes per cubic millimetre during the latter months is the average for a primipara, and that this increase occurs in "most primiparae", while in only 50% of multiparae does any leucocytosis occur, and that in these cases such leucocytosis is lower than in primiparae. He states/

states that from the last weeks of pregnancy to the beginning of labour, there is an increase in leucocytosis from 16,000 to 18,000 per cubic millimetre. After parturition, he made observations in 12 cases, 3 being multiparae and 9 primiparae and found a leucocytosis of from 10,000 to 37,000 per cubic millimetre in primiparae and one of 11,000 to 16,000 per cubic millimetre in multiparae.

Da Costa states that the majority of primipara show a leucocytosis in the later months of pregnancy, moderate in amount, and involving an increase of usually not more than double the normal count, while in multiparae, the excess is only to the extent of one-sixth of the normal. He says the height of the leucocyte count occurs just before and after delivery, after which, the leucocytosis diminishes steadily and disappears before the end of the first week of the puerperium in normal cases. He adds that the increase is higher both in multiparae and primiparae in younger women than in those approaching middle age.

Hibbard and White examined the blood of 55 cases, 33 of whom were primiparae and 22 multiparae, the ages ranging from 16 to 41. The conclusions they arrive at from their investigations, are that a/

a leucocytosis exists before delivery in 84% of primiparae and in 75% of multiparae. In 32 primiparae, they found an average leucocytosis of 15021 per cubic millimetre, that is, an increase of 50% over the normal count. The average for 20 multiparae, they found to be 11,700 per cubic millimetre, or an increase of 17% above the normal. The average count just before delivery, e.g., at term, in 22 primiparae, they set down as 16,100 leucocytes per cubic millimetre, and in 17 multiparae, as 11,800 per cubic millimetre, both these estimates being made in patients with perfectly normal pregnancies. Their observations during the puerperium showed them that the leucocytes dropped rapidly in numbers after delivery, reaching the normal on 4th or 5th days, rising again slightly on the 7th day, subsequently falling again to normal. The rise on the 7th day, they ascribe to the indurated condition of the breasts at this time. Their estimations were comparatively higher in younger women than in the more elderly ones.

In five multiparae in whom there was more haemorrhage at the time of delivery than normal, they found a leucocyte count of 1,500 per cubic millimetre above the average after delivery. In 2 cases/

cases, one a primipara, the other a multipara, who had severe post-partum haemorrhage, the leucocyte counts rose to 30,000 or 40,000 per cubic millimetre above the average for the first five days. They were able to examine four primiparae with simple mastitis during the puerperium, accompanied by a sharp febrile attack, and found a leucocytosis of 11,000 to 19,000 per cubic millimetre during the rise of temperature, but subsiding directly with the fall in temperature.

In 3 cases of Puerperal Septicaemia of moderate severity, they found a marked increase in the leucocytes amounting to 14,000 - 17000 per cubic millimetre in two cases. These were curetted and treated with antiseptics and the leucocyte count immediately fell. In the third case, the leucocyte count was unaffected by the Septicaemic condition, but running its normal course. This, at first sight, seems strange, but such discrepancies in Septicaemic conditions have been observed by many others; the explanation being that a leucocytosis only occurs in cases of marked, but not excessive severity, while in very mild cases, we find no leucocytosis necessary and also in extremely severe cases, where the poison is most virulent, the/

the patient is unable to cope with it by sending out into the circulation a large excess of leucocytes. It is readily seen then, of what importance from a prognostic point of view a leucocyte count would be in a case of Septicaemia.

Cabot quotes 11 cases of Septicaemia in 8 of which there was a leucocytosis of 18,400-35,600 per cubic millimetre, followed by recovery. In one case in which the patient died, there was a leucocytosis of 77,500 and in another, only 5,600 leucocytes were counted in the cubic millimetre.

Da Costa in examining 21 cases of Puerperal Septicaemia, found a leucocytosis of 13,852 per cubic millimetre, while in 12 cases, the average leucocytosis was much more marked, being 18,793 per cubic millimetre. Those Puerperal Septicaemic cases examined by Limbeck and Krebs showed no leucocytosis, but they state that some of these cases were fatal ones and the rest very mild ones.

Kosina and Eckert state that their investigations led them to believe that there is a leucocytosis present in all cases of Septicaemia and that it is proportionate to the severity of the attack, and falls again during convalescence, from which one gathers that they did not examine any fatal cases/

cases, and possibly no very mild ones; otherwise, their conclusions are diagonally opposite to the views held by most investigators on the subject.

With regard to the Red Cells in Puerperal Septicaemia, it is interesting to note that all are agreed on one point, and that is the marked decrease in their number.

Roscher's investigations led him to state that this decrease is greater in this condition than in any other infective disease, and moreover, that this occurrs earlier in the disease than is usual.

In the 10 cases quoted by Cabot the red cells range between 2,300,000 and 4,904,000 per cubic millimetre, and in one case, they numbered 5,368,000, which is astoundingly high, being nearly 1000000 above the normal for a healthy woman. This patient moreover, had only 5,600 leucocytes per cubic millimetre at this time and the case ended fatally. In very severe cases, the red cells have frequently been reported below 100,000, but in less severe cases from 2,500,000 to 3,500,000 per cubic millimetre may be expected. With this brief review of the previous work on this subject, we may now pass to an analysis and more detailed consideration of the results obtained in this present investigation, and the/

the following tables will indicate more clearly one of the points to which we wish to draw more special attention.- I may add that with regard to these tables (V. and VI.), that the observations there shown were made on the first or second day of the puerperium, mostly on the second day.

Table V. Primiparae.

Case	Leucocytes per c.m.m.	Polymorpho-nuclear cells	Large Lymph-ocytes and Transition-al Forms	Small Lympho-cytes	Eosino-philes
No.15	18750	85.7	4.9	8.3	1.1
No.18	12500	72.2	7.3	19.1	1.4
No.34	18437	86.6	4.3	8.3	.8
No.35	18750	77.8	9.2	11.7	1.3
No.45	17500	81.3	5.5	12.6	.6
No.50	15625	83.3	6.5	9.5	.7
Average		81.15	6.27	11.58	.97

Table VI. Multiparae.

Case	Leucocytes per c.m.m.	Polymorpho-nuclear cells	Large Lymph-ocytes and Transition-al Forms	Small Lympho-cytes	Eosino-philes
No.24	18750	82.3	7.3	10.	.4
No.29	10625	73.1	10.2	16.2	.5
No.31	19687	79.7	5.9	13.7	.7
No.36	15937	84.2	2.6	12.7	.5
No.41	18750	85.	6.	8.5	.5
No.46	20000	79.1	6.3	14.3	.3
No.47	11250	82.6	6.4	10.3	.7
No.49	13750	75.7	8.5	15.2	.6
Average		80.21	6.65	12.61	.52

The above tables show differential counts of leucocytes (1) in primiparae, (2) in multiparae.

Before going on to the consideration of the differentiation of the kinds of leucocytes involved in the leucocytosis of the puerperium, it will be of value, I think, to have clearly before us, what varieties of leucocytes are met with in normal blood. There are six varieties, which are recognised.

I. SMALL LYMPHOCYTES:

These cells are small, measuring from 5 to 10 m. in diameter. They consist principally of a single round nucleus with a thin rim of protoplasm, the former usually stains a very faint blue with Leishman's stain; the latter is dark blue and semi-granular looking.

II. LARGE LYMPHOCYTES:

These cells are very much larger than thost just described, measuring 11 m., or more in diameter. They are usually ovoid in shape, but sometimes appear "slipper shaped", being apparently much less resistent to distortion in the process of making the film than other cells. The nucleus follows very much in shape that of the cell as a whole; it is generally situated rather to the periphery of the cell. As a rule, the surrounding protoplasm, though small in amount, is greater proportionately than/

than in the preceding variety; in some, however, the protoplasm is quite large in amount.

III. TRANSITIONAL FORMS:

These forms closely resemble the large lymphocytes in size and shape, the principal difference lying in the fact that the nucleus is not oval or round as in this variety, but is indented and drawn out into a kind of crescent, giving the appearance of an oval nucleus being doubled on itself at the middle, the concavity of the nucleus being of course, towards the centre of the cell. The nucleus is usually more deeply stained than in the large lymphocyte, but less so than in the Small variety. These last two varieties of cells are non-granular.

IV. POLYMORPHONUCLEAR CELLS with neutrophile granulations (Ehrlich) or the "Finely granular oxyphile cells" of other authors. These are by far the commonest form found. They are round in shape and measure from 10 to 12 m. in diameter. The characteristic features of these cells are the shape of their nuclei and the granular nature of their protoplasm. The nuclei are very much twisted and may assume almost any shape, sometimes being distinctly/

distinctly horse-shoe shaped, at others, lobulated, and drawn out into a figure resembling an S, a Z or a V. Sometimes, the lobulations of the nucleus appear to be quite distinct and separate; they are, however, really connected by thin chromatin strands. They nucleus stains of a deep blue colour with Methylene blue. Its irregular shape Arnold considers an evidence of the amoeboid activity of the cell, rather than of degeneration, as previously thought. The protoplasm of the cell contains an enormous number of small irregularly shaped granules, which, with Leishman's stain, frequently appear pink. The jelly-like substance in which these very fine granules are lying, stains a pale pink with Eosin and Methylene Blue.

V. EOSINOPHILE CELLS:

These are of much the same size as the polymorphonuclear variety. The nucleus is irregular in shape like these and eccentrically placed, but the surrounding protoplasm is filled with large spherical granules staining a bright red with eosin. These granules are the characteristic of these cells and consequently, the cells are sometimes called "coarsely granular oxyphile cells" just as the Polymorphonuclear variety are sometimes called "finely granular oxyphile cells".

VI. BASOPHILE CELLS:

VI. BASOPHILE CELLS:

These are extremely rare in normal blood, but are occasionally met with, and so must be mentioned. They have an irregular shaped nucleus like a polymorphonuclear cell, but the fine granules, instead of having an affinity for acid stains, have an intensely basic reaction and stain Blue with Methylene Blue and Eosin.

I append the percentage of these varieties of cells, as they appear in normal blood.

Polymorphonuclears	60 - 75%
Large Lymphocytes and Transitional Forms	4 - 8%
Small Lymphocytes	20 - 30%
Eosinophiles	.5 - 5%
Basophiles	.1 - .2%

Comparing this normal relation of the varieties of leucocytes to each other with Tables V. and VI., page 96, we see at a glance that the leucocytic increase of the puerperium is due to a preponderance of the Polymorphonuclear cells at the expense of the other varieties and, comparing Tables V. and VI. with each other, we see that there is no marked difference between the differential counts of multiparae and primiparae.

With regard to the observations as to the differential counts of the Leucocytosis of Pregnancy and the Puerperium arrived at by various investigators, we find that Bjorkman says the leucocytosis is due to an increase in the lymphocytes and that this is very constant in primiparae.

Rieder, on the other hand, considers that all the varieties are equally and proportionately increased.

Hibbard and White found that in four absolutely normal puerperal cases, the proportion of leucocytes was normal. In 15 other cases, they found an absolute increase (86.2%) in the polymorphonuclear variety.

Henderson found in 32 strictly normal cases that the polymorphonuclear cells were in excess, the average being 78.7%.

In my 12 cases (vide Tables V. and VI., page 96), I also find an undoubted increase in the polymorphonuclear variety, the average being 80.5%; this closely approaches Henderson's results.

The importance of a differential count in estimating the degree of leucocytosis in any case, must be emphasised. The essential point in a leucocytosis is an increase in the polymorphonuclear variety, and a comparatively low count with a high percentage/

percentage of those cells is of greater significance than a higher count in which the normal relation of the various kinds of leucocytes is retained.

We are in a position now to discuss more in detail our results and to see how they compare with those ot others, who have made observations on this subject.

As has been seen, the principal investigation has been on the leucocytes, but we may first briefly refer to observations made on the Red Blood corpuscles. Referring to Table VII., page 86 and taking the average given there, of 4,131,050 cells per cubic millimetre, we find that this corresponds to the observations of other investigators. Da Costa for instance, states there is especially in primiparae a slight decrease in the number of red blood corpuscles, particularly at the end of pregnancy; the average red blood count for a healthy woman being taken to be 4,500,000 per cubic millimetre.

We now turn to an examination of the leucocytes.

A. At the end of Pregnancy.

B. During the Puerperium.

A. THE LEUCOCYTES AT THE END OF PREGNANCY:

The leucocytes at term were examined in 12 primiparae. By referring to Table I., page 82, it is seen that there is a range of from 10,937 to 35,625 leucocytes per cubic millimetre, the average being 19,192 per cmm. This is rather higher than that observed by Hibbard and White, but lower than Henderson, whose average is 21,969 per cmm. in 13 cases. Turning to Table II., page 82, we find that the average number of leucocytes at term in 16 multiparae, stands at 14,628 per cubic millimetre, this being very much below Henderson's computation, but corresponds more nearly with Hibbard and White's results, viz., 11,800 per cmm. We see then from the Tables I. and II. that primiparae at term, have a leucocytosis exceeding that of multiparae by 4,464 per cmm. It is extremely difficult to find an explanation for this difference.

If we were to assume that the excess were for protective purposes in all cases, and this theory is discussed later, it would not require a great stretch of imagination to expect a greater production of leucocytes in primiparae, since the risks attending a first pregnancy are infinitely greater than those of subsequent ones.

B. We now come to the LEUCOCYTOSIS OF THE PUERPERIUM:

From a study of the foregoing 50 cases, we see that on the first day of the puerperium in normal cases that we have an average of 17,121 leucocytes per cubic millimetre in 20 primiparae, which means a drop of nearly 2,000 cells per cubic millimetre within twenty-four hours of delivery; whilst in multiparae, the average in 23 cases is 13,692 per cubic millimetre, being a drop of 1,000 since delivery. By referring to Charts III. and IV., pages 84 and 85, we see that the fall in leucocytes for the first four days is very considerable; after this, the decrease is not so markedly rapid. On Chart III., we see a slight rise on the 7th day, but not a very marked one. By looking back at the 20 cases from which this chart is constructed, we find that a more definite rise than shown on the "average" chart, occurs on the 7th or 8th days in 10 cases, while in the 23 cases of multiparae from which Chart IV. is drawn, there is a rise in 10 cases; this, however, is represented on the composite chart (Chart IV.) by a fall of 59 cells per cubic millimetre, or what it practically comes to, a stationary condition of the cells on the 7th day.

After/

After this, the leucocyte curve falls again steadily to the 10th day, when we find counts of 8,845 and 8,431 cells per cubic millimetre in primiparae and multiparae respectively, this being only about 1,000 cells per cubic millimetre above the normal non-parturient condition. I had not the opportunity of examining patients after this time, except in abnormal cases, so that it is impossible for me to say how long the leucocytosis lasts into the period of lactation. Da Costa is of the opinion that it ceases practically after the first week, while others maintain that it is continued in a mild degree for some weeks of the process of lactation.

THE SIGNIFICANCE OF THE LEUCOCYTOSIS OF PREGNANCY AND THE PUERPERIUM.

I. That leucocytosis occurs after a large haemorrhage, within an hour even of the occurrence, all are agreed, but that this is the explanation of the cause of leucocytosis during the puerperium, is untenable, after a careful examination of the blood before parturition. For here we have seen that leucocytosis not only exists, but reaches its maximum just before delivery. The effect of a severe case of Post-Partum Haemorrhage on the leucocyte count in the early puerperium from lack of such a case, I have been unable to study, but there can be little doubt that such an event occurring after labour, would undoubtedly interfere with the normal fall in the leucocytes of from 1,000 to 2,000 cells per cubic millimetre on the first day of the puerperium.

II. During digestion, we have seen that there is a leucocytosis present in most healthy individuals, the increase in the leucocytes being, according to Rieder, one of about 33%.

Da Costa advances the theory that the leucocytosis/

cytosis of pregnancy is one of prolonged digestion, "the mother having to eat and digest for two"; he bases this theory on the fact that the leucocyte count of pregnancy is not affected by a meal, that is, that it always remains high, never decreasing after digestion is over. In order to keep up a condition of the blood representing digestion, one would suppose that the individual would have to eat and assimilate very much larger meals of proteid food than that taken by a non-pregnant person, and that one digestion would not be complete before fresh ingestion of food required the disgestive processes to remain in action. As a matter of fact, we do not find that pregnant patients, especially when approaching term, indulge in large proteid meals at frequent intervals, but on the contrary, very often are disinclined for food, and therefore rather tend to decrease the amount of food taken, than to increase it. Besides, such an excess of food would soon become a severe tax on the digestive mechanism, leading sooner or later to a breakdown in that process. Then again, we find the leucocytosis of pregnancy to be much less common in multiparae than primiparae, and when present, always existing to a much smaller extent, and it is difficult/

cult to understand why the foetus of a multipara should require less nutriment than that of a primipara, which seems the natural corollary to be drawn from the above proposition.

III. Virchow points out that during pregnancy, there is a gradual increase in the size of the lymph vessels and the pelvic glands about the uterus, and consequently, an influx of fresh leucocytes in the circulation is thus brought about. Against this, we have the fact that the increase in the leucocytes does not consist in a uniform increase of all the varieties in their normal proportions, but by referring to Tables V. and VI., page 96, we see that the polymorphonuclear cells are in excess at the expense of the other varieties, and these are certainly not produced in glands and lymph channels, but from the bone marrow as demonstrated by Ehrlich, Muir and others.

IV. But I would suggest that this leucocytosis may possibly have another and more important significance.

Firstly, let us see what evidence there is of the existence of a toxaemia in normal Pregnancy.

THE TOXAEMIA OF PREGNANCY:

The origin and nature of the poisons which are evolved during pregnancy, leading frequently to serious risks to mother and child, have hitherto not been elucidated, though much time has been devoted by many upon the subject. When one comes to consider how assimilation and excretion are going on at the same time in the mother and her foetus, one recognises that there must be very intricate chemical changes and increased tissue metabolism involved in the process. That such processes sometimes are somewhat defective is therefore not to be wondered at, and we find that poisons, moreover are produced in the body of the foetus or of the mother, or possibly in both, which have their characteristic effects upon the Nervous System of the mother.

The urine of patients in whom the natural process of excretion was defective and had lead to an explosion, cerebral in type, has been investigated by many and consequently the variety of poisons isolated from such a Urine is multifarious. Some of the more important results obtained, must be considered here.

Duhrssen points out that Creatin and Creatinin are/

are present in excess of the normal 15 grains daily, and that this leads to cerebral irritation and convulsions.

Budin has shown how poisons are absorbed from the intestinal canal, especially when any mechanical intestinal stasis is produced.

Charpentier injected the urine of pregnant women into rabbits; this was found to produce convulsions and rapid death, the only post mortem changes found, being acute congestion of the Kidneys.

Blanc injected the urine of non-pregnant women into rabbits and found that urine of some non-pregnant women was somewhat poisonous, but that the urine of pregnant patients was very much more toxic, giving rise to the distinct phenomena of poisoning.

Fischer finds that in examining the kidneys of pregnancy after the 5th month that congestion of the kidneys existed in two-thirds of his cases, simulating that found after the experimental inoculations on rabbits.

The bacteriological condition of the Blood has been carefully studied by Blanc, who produced albuminuria, suppression of urine and convulsions in animals inoculated with the toxic substances from the/

the blood of patients suffering from the toxaemia of pregnancy. The Blood from this point of view is entirely disorganised.

Blanc examined the blood of a patient with convulsions and albumin and casts in her urine and found that cultures from it showed pathogenic organisms growing in 48 hours, and these being injected into rabbits produced albuminuria and toxaemia in them.

Levanowitsch examined the blood of 44 eclamptic patients. He found and isolated large cocci, which, when injected into rabbits, produced haemorrhagic endometritis and severe anaemia. Many other observers have corroborated this question of the Bacterial invasion of the blood.

Tarnier and Chambrelent go as far as to assert that the degree of intoxication in a pregnant woman can be guaged by the toxicity of her Blood Serum. The precise agent involved in the production of eclampsia, for instance, is unknown at present, but basing one's ideas on the theory of deficient excretion and thus accumulations of poisons in the system generally, the question of how perfect is the excretion is an important one, and can be ascertained by estimating the daily amount of Urea passed in the Urine, for Hermann and Davis found that in 84 perfectly/

perfectly normal pregnancies, the Urea was diminished until after labour to the extent of .5%.In a case of regular Toxaemia as exemplified by Eclampsia, we know that Urea is very markedly diminished.

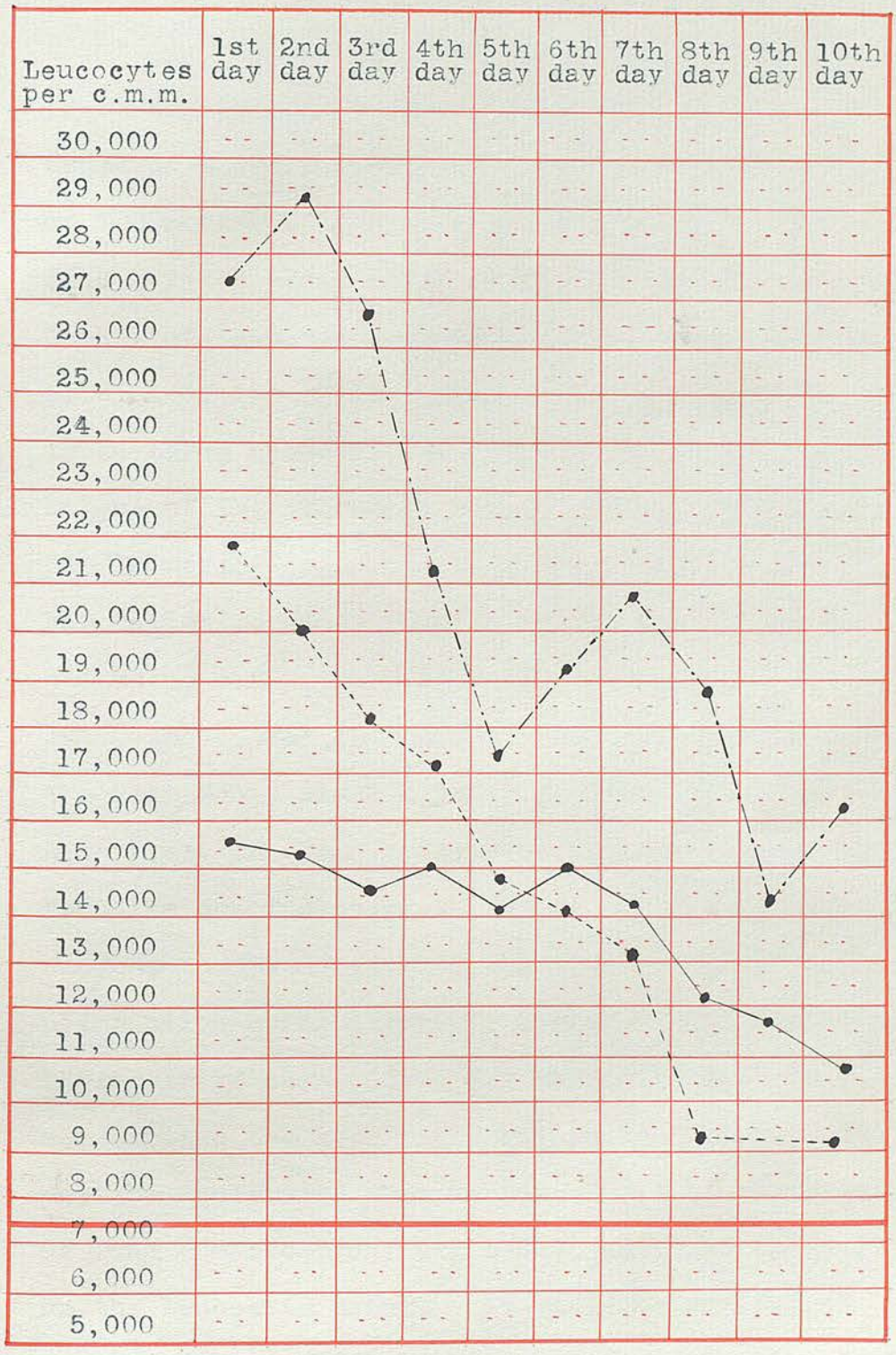
We thus see that the conditions produced by advanced toxaemia are probably those caused by the circulation of highly toxic blood serum. Moreover, that there must be a(very)mild degree of toxaemia present in the normal pregnant patient, since her urine is found to be so much more toxic than that of those non-pregnant patients whose urine showed slight toxic qualities when injected into animals. Various forms of organisms are evidently to be found in the blood of toxaemic patients. That there should be a provision of nature to cope with the effete products and their toxines during pregnancy and so prevent the explosion which we see occurring only in about .2% of cases, viz., Eclampsia, is only what one might expect.

Seeing that we find this barrier or line of defence in other toxic conditions, such as empyoema, Appendicitis, Pneumonia, Scarlet Fever, etc., and that it is supplied by a large excess in the leucocytes of the blood, I am inclined to the opinion that very probably the leucocytosis of pregnancy/

pregnancy may be connected with the disintegration of toxins in the circulation and possibly, of actual pathogenic organisms in complicated cases.

During pregnancy, all the organs of the mother adapt themselves to the new condition of affairs; changes in the breasts appear early, the heart hypertrophies, sweat glands become more active, the properties of the urine are changed, etc., etc. Why should not the blood find it necessary to increase that variety of cell which is instrumental in the absorption and destruction of dilaterious substances. I think that here we find quite a possible explanation for the Leucocytosis of Pregnancy, and I do not know that such an explanation has been advanced before. And indeed, in the course of the present investigations, I have been able to obtain some observations in cases which seem to bear out some further evidence of the truth of the above hypothesis. As I have already pointed out, I have been able to examine the blood of two typical cases of eclampsia, and of a third patient, who, but for the presence of a definite convulsion, presented all the symptoms of that condition. These are seen in Cases, 14, 15 and 46. For convenience, I append a chart showing the leucocyte curves in these three cases.

Chart VIII



This composite Chart denotes the leucocyte curves in Cases 14, 15 and 46.

——— denotes Case 14.

-·-·-·-·- denotes Case 15.

..... denotes Case 46.

If we regard the leucocytosis of pregnancy as evidence of a toxic condition, dependent in some way on the presence of the living foetus in utero, we find a ready explanation of the sudden drop in the number of leucocytes immediately following the expulsion of the child. The striking feature of these three cases of eclampsia is the sustained height of the leucocyte curve. Thus, on the 6th day in normal cases, we find the leucocyte count has fallen on an average to 9,600, whereas in the eclamptic cases, we find counts of practically 1900, 1500, 1400 leucocytes per cubic millimetre and the high count still further maintained, as may be seen from the Chart. May not the explanation be found in the increased amount of toxic substance present in these cases? the time required for elimination being naturally longer. The fact that in the third case, (Case 46) the child died in utero may explain the more rapid return to normal. It must be remembered that in Case 15, that the presence of lung complications might have assisted in keeping up the leucocyte count. It would be unwise, of course, to lay special stress on any deduction from such a small number of cases, but the observations seem worthy of note.

In a paper which appeared in the Laboratory Reports in 1889 relating to the process of involution of the uterus after delivery, I find that Helme considers the process is brought about by the appearance in the uterus during the last days of pregnancy (when the leucocyte count is reaching its maximum) of large cells, which coalesce and form a plasmodium, and that by the end of pregnancy there is a large number of these cells ready for the process of eating up the waste material around them. He adds that these cells have entirely wandered off from the uterus by the 6th day, and probably find their way to the Circulation, either as plasmodia, or breaking up again into their original elements. It is just possible that the leucocytosis of pregnancy and the puerperium may, in some way, be connected with these large phagocytic plasmodia; but I am bound to say that in the hundreds of specimens of blood I have examined for this paper, I have never come across any cell either at all resembling the amoeboid cells mentioned by Helme, or any cells which might be taken to represent a part of these cells, though I have looked for them in every specimen of blood I have examined.

Polymorphonuclear/

Polymorphonuclear cells are typically "scavengers" in their functions; they carry away effete products and destroy foreign bodies, whether they be bacteria or otherwise, and it appears to me that after their function during pregnancy is over, namely, coping with the toxines present, I say after this demand upon their presence is over, there are yet two functions open to them. Firstly, they may aid in the carrying away of effete products in connection of the involution of the uterus.

But secondly, since their fall in numbers to approximately the normal, does not occur till the 5th and 6th days, and is by the 3rd day that we expect to find the manifestations of septic changes occurring in utero, does it not at once suggest itself to one that their function at this time is a protective one? that they prevent the entrance of pathogenic organisms, or should these gain entrance, lead to their destruction.

SUMMARY AND CONCLUSIONS.

In attempting to make a brief summary of the results of this investigation, I must repeat that the main object in view, was the determination of the leucocyte curves in the normal puerperium. The uniformity of the results obtained leads one to the conclusion that there is a distinct leucocytosis during pregnancy in primipara and also, but to a smaller extent, in multipara, and that it reaches its maximum at term. Besides this, we see that a standard leucocyte curve during the puerperium does exist, and in this curve we appear to have a record of the patient's progress towards recovery, approximating to the information obtained from the examination of the pulse and more regular than the corresponding temperature chart.

The striking fact in the leucocyte curve of the puerperium, is the rapid and regular fall in the first four days of the puerperium, from the comparatively high count existing at term, and as it is during this time that manifestations of septic complications generally show themselves, we should regard with suspicion any case in which the leucocyte count/

count remains high or rises above this normal standard. And we must remember, of course, that a leucocytosis may be due to other causes than puerperal sepsis. The presence of an inflammatory focus in the body, apart from the pelvis, may produce a similar rise.

Hibbard and White, for instance, have shown that a simple mastitis may give rise, to an independent leucocytosis, a pneumonia of course, and apparently, a Uraemic condition also will produce the same effect. But in the absence of such conditions, and they can generally can be excluded, a leucocytosis higher than that normally present must put us on our guard and make us use every means in our power to eliminate the possibility of puerperal sepsis. It will not be surprising, and indeed, will only be in accord with what has been found in other conditions if such a leucocytosis should sometimes prove the first warning that puerperal infection has occurred. The evidence we obtain, however, from the estimation of the leucocytès, must always be considered in conjunction with the evidence obtained from other sources. It can never take the place of careful clinical examination. Incidentally, in the investigation also, we have confirmed the/

the observation that the leucocytosis is essentially a polymorphonuclear leucocytosis, and would beg to again direct attention to the suggestion that the leucocytosis of pregnancy is essentially toxic in origin and that it indicates in some way, a reaction on the part of the mother to toxic substances of metabolic origin set free from the altered physiological processes dependent on the presence of the foetus in the uterus. Naturally, in a series of observations such as the present, one did not expect to find many examples of puerperal sepsis, and consequently, I am unable to give examples of puerperal complications to contrast with the foregoing normal cases. It will be my endeavour, however, in the future as occasion offers, to extend my observations in the direction of abnormal cases. When a larger number of those cases have been placed on record, it may be found possible to determine the precise value of an examination of the blood in the puerperium. There can be little doubt, however, from what has been found in other branches of medicine and in other diseases, that the estimation of the leucocytes will form a valuable addition to the means at our disposal for the diagnosis of puerperal disease.

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